as that present in malted grain (see Brewing) or secreted by certain living organisms, or by an acid such as sulphuric acid. The latter process is little employed at the present time. The materials employed by the distiller, and the methods of pre-paration and treatment to which they are subjected before and after entering the distillery, are in some respects similar, in others materially different, from those employed by the brewer. The materials most frequently employed are maize, rye, barley malt, raw barley, oats, wheat and potatoes. Com­paring the main operations (apart from the actual process of distillation) of the brewer with those of the distiller, it is true that these are identical in the sense that they consist in the conversion of starch into sugar and of the latter into alcohol; but whereas the object of the brewer is to produce beer, of which alcohol forms only a relatively small proportion, the distiller, broadly speaking, desires to produce alcohol, and it is this fact which is responsible for the differences alluded to above.

*Distillery Malting.—*Where malt is employed as the main raw material, as, for instance, in the case of Scotch pot-still whiskies, and also, but to a minor degree, in Irish pot-still whiskies and patent-still whiskies, the process of preparation does not, except in some specific particulars, differ very widely from that used in making brewer’s malt (see Malt). With regard to the barley employed for this purpose, certain qualities which are of the greatest importance to the brewer, such as the nature of the husk, colour, and friability of the starch, are of little interest to the distiller, and providing that the grain is sound and that it contains a high percentage of starch and malts as well, it will pass muster as an average distillery material. It is usual to give barley intended for patent-still work a rather longer period in the steep and on the floors than in brewery malting, and it is well to treat the steep-water with some anti­septic, preferably lime, as the distiller has not the opportunity of lessening the dangers of bacterial infection at subsequent stages which is afforded to the brewer by the boiling and hopping of the wort. In distilleries where barley malt is not used as the main raw material, but mainly or chiefly as a diastatic agent (for instance, in potato and maize distilleries on the continent of Europe), the so-called “long” malt process is widely em­ployed. This consists essentially in subjecting the grain first to a somewhat lengthy steep (until the increase in weight due to the absorbed water is about 40 to 45%), and secondly to a very prolonged “ flooring ” at a moderate temperature, great attention being paid to the conditions of ventilation and humidity. It was formerly believed that the germinating barley grain attains its maximum of diastatic power after a very short period, and that when the acrospire is three-quarters “ up ” and the rootlets say one and a half times the length of the grain, the malt is ready for removal from the floor. Μ. Delbruck, Hayduck and others have, however, shown that this is not the case, and the practical results obtained by adopting the twenty days’ “ floor­ing ” period (and its attendant conditions) have amply confirmed the scientific researches on this subject.

Hayduck has shown that the relative diastatic strengths of " short ” (seven to ten days) and “ long ” (twenty days) malt are, (1) for heavy barleys as 100: 128·5 (average), (2) for light barleys as 100: 160∙5 (average). In contradistinction to the brewer (who can only use it on exceptional occasions and for special purposes), the distiller prefers, whenever this is feasible, to use green malt rather than kilned malt. One of the principal objects of kilning brewing malt is to restrict the diastatic power; but this is the very factor which the distiller desires to preserve, as the green malt possesses roughly twice the diastatic activity of high kilned malt. It is obvious that the distiller, who regards his malt merely as a starch-con verting agent, will, *ceteris paribtus,*use as little kilned malt as possible. The malt whisky distiller cannot, however, use green malt, as he relies to a great extent on the kilning process for the development of the peculiar flavour characteristic of the article he produces. Moreover, it is frequently difficult during hot weather to obtain a satis­factory green malt supply, especially as the latter will not bear carriage for any distance, and distillers who make pressed yeast (commonly called “ German ” yeast) find that a proportion of kilned malt is necessary for the satisfactory manufacture of this article. When the distiller is unable to use green malt he will, by preference, use a malt which has been kilned at as low a temperature as possible. Under these conditions the kilning is little more than a drying operation, and the temperature is rarely raised above 130° F.

Although green or low-dried barley malt is the saccharifying agent usually employed both in the United Kingdom and on the continent of Europe, malts prepared from other cereals are not infrequently employed for this purpose. According to Glaser and Moransky the relative starch-transforming capacities of the various malted grains, taking barley as the unit, are as follows:—

Barley malt 1·00

Rye malt 0·93

Wheat malt 1∙08

Oat malt 0∙30

Maize malt 0∙28

Oat malt, notwithstanding its low transforming power, possesses certain advantages, inasmuch as it is easily and rapidly prepared, it acts very quickly in the mash tun, and its diastatic power is well maintained during fermentation. Rye is best malted in conjunction with a little barley or oats, as it otherwise tends to superheat and to grow together in a tangled mass.

*Distillery Mashing.—*Distillery mashing, although outwardly very similar to the process employed in brewing, differs very widely in some important particulars. In brewing all the necessary fermentable matter is formed from the starch by the mashing operation. The wort so obtained is then hopped and sterilized. This method of working, however, cannot be adopted by the distiller. The brewer must have a certain proportion of dextrinous, non-fermentable carbohydrate matter in his wort; the distiller, on the contrary, desires to convert the starch as completely as possible into fermentable, that is, alcohol-yielding, material. This result is obtained in two ways: first, by mashing at low temperatures, thus restricting the action of the diastase less than is the case in the brewer’s mash; and, secondly, by permitting the diastatic action to continue during the fermentation period. Low temperature mashing alone will not have the desired effect, for part of the dextrinous bodies resulting from diastatic starch-transformation are not further degraded by diastase alone, but are rendered completely fer­mentable by the combined action of diastase and yeast. Hence the distiller is unable to boil, that is, to sterilize his wort, as he would thereby destroy the diastase entirely. In this he is at a serious disadvantage compared with the brewer, as an unsterilized wort is very liable to bacterial infection. The latter danger prevents the distiller from taking full advantage of the benefits of low-temperature mashing, and he is obliged to heat his mash to a temperature which will, at any rate, be a partial safeguard against the bacterial evil. The method employed varies according to the nature of the mash and the quality of the spirit that it is desired to obtain, but in principle it consists, or should consist, in bringing the mash as rapidly as possible to the temperature of maximum saccharification, keeping the whole at this point for some little time, then heating to the temperature of maximum liquefaction, and subsequently to as high a temperature as is consistent with the thickness of the mash and the preservation of sufficient diastase for the fermenting period.

*The Fermenting Operations.*—The conditions and methods of distillery fermentation vary considerably, and in some respects radically, from those employed in the brewery. In order to obtain the maximum alcohol yield the distiller is obliged to work with unstcrilized wort, and at relatively high temperatures. The necessity for the former condition has already been ex­plained, but the latter is due to the fact that the optimum working capacity of distillery yeast is reached at a temperature markedly above that most favourable to brewing types. Apart from this, if the distiller worked at brewing temperatures the