of their liability to contain free alkali and unsaponified oil, the process has been largely given up.

The process of soap-boiling is carried out in large iron boilers called “ soap pans ” or “ coppers,” some of which have capacity for a charge of 30 tons or more. The pan proper is surmounted by a great cone or hopper called a curb, to provide for the foaming up of the boiling mass and to prevent loss from overflowing. Formerly the pans were heated by open firing from below; but now the almost universal practice is to boil by steam injected from per­forated pipes coiled within the pan, such injection favouring the uniform heating of the mass and causing an agitation favourable to the ultimate mixture and saponification of the materials. Direct firing is used for the second boiling of the soap mixture; but for this superheated steam may with advantage be substituted, either applied by a steam-jacket round the pan or by a closed coil of pipe within it. In large pans a mechanical stirring apparatus is pro­vided, which in some cases, as in Morfit’s steam " twirl,” is formed of the steam-heating tubes geared to rotate. Autoclaves, in which the materials are boiled under pressure, are also employed for certain soaps.

The process of manufacturing soaps by boiling fatty acids with caustic alkalis or sodium carbonate came into practice with the de­velopment of the manufacture of candles by saponifying fats, for it provided a means whereby the oleic acid, which is valueless for candle making, could be worked up. The combination is effected in open vats heated by à steam coil and provided with a stirring appliance; if soda ash be used it is necessary to guard against boiling over. (See under *Curd Soap.)*

*Curd Soap.*—This variety is manufactured by boiling the fat with alkali and removing the unused lye, which is afterwards worked up for glycerin. The oil mixture used differs in the several manu­facturing countries, and the commercial name of the product is correspondingly varied. In Germany tallow is the principal fat; in France olive oil occupies the chief place and the product is known as Marseilles or Castile soap; and in England tallow and palm oil are largely used. But in all countries a mixture of several oils enters into the composition of curd soaps and the proportions used have no fixity. For each ton of soap to be made from 12 to 16 cwt. of oil is required. The soap pan is charged with the tallow or other fat, and open steam is turned on. So soon as the tallow is melted a quantity of weak lye is added, and the agitation of the injected steam causes the fat and lye to become intimately mixed and pro­duces a milky emulsion. As the lye becomes absorbed, a condition indicated by the taste of the goods, additional quantities of lye of increasing strength are added. After some time the contents of the pan begin to clear and become in the end very transparent. Lye still continues to be poured in till a sample tastes distinctly alkaline—a test which indicates that the whole of the fatty acids have been taken up by and combined with the alkali. Then without further addition of alkali the boiling is continued for a few minutes, when the soap is ready for salting out or “ graining.” Either common salt or strong brine in measured quantity is added to the charge, and, the soap being insoluble in such salt solution, a separation of con­stituents takes place: the soap collects on the surface in an open granular condition, and the spent lye sinks to the bottom after it as been left for a short time to settle. Suppose that a pure soap without resin is to be made—a product little seen in the market— the spent lye is run off, steam is again turned on, pure water or very weak lye run in, and the contents boiled up till the whole is thin, close and clear. The soap is from this again grained off or salted out, and the underlye so thrown down carries with it coloured impurities which may have been in the materials or which arise from contact with the boiler. Such washing process may have to be repeated several times when impure materials have been used. The spent lye of the washing being drained off, the soap is now "boiled for strength.” Steam is turned on, and, the mass being brought to a clear condition with weak lye or water, strong lye is added and the boiling continued with close steam till the lye attains such a state of concentration that the soap is no longer soluble in it, and it will separate from the caustic lye as from a common salt solution. The contents of the pan are once more allowed to cool and settle, and the soap as now formed constitutes a pure curd coap, carrying with it some pro­portion of uncombined alkali, but containing the minimum amount of water. It may be skimmed off the underlye and placed direct in the frames for solidification ; but that is a practice scarcely at all followed, the addition of resin soap in the pan and the subsequent "crutching in ” of silicate of soda and adulterant mixings being features common to the manufacture. The lye from the strengthen­ing boil contains much alkali and is used in connexion with other boilings.

*Mottled Soap.—*A curd soap prepared from kitchen fat or bone grease always carries with it into the cooling frame a considerable amount of coloured impurity, such as iron sulphate, &c. When it is permitted to cool rapidly the colouring matter remains uniformly disseminated throughout the mass; but when means are taken to cause the soap to cool and solidify slowly a segregation takes place : the stearate and palmitate form a semi-crystalline solid, while the oleate, solidifying more slowly, comes by itself into translucent veins, in which the greater part of the coloured matter is drawn. In this way curd, mottled or marbled soap is formed, and such mottled appearance was formerly highly valued as an indication of freedom from excess of water or other adulteration, because in fitted soaps the impurities are either washed out or fall to the bottom of the mass in cooling. Now, however, the mottled soaps, blue and grey, are produced by working colouring matter, ultramarine for blue, and manganese dioxide for grey, into the soap in the frame, and mottling is very far from being a certificate of excellence of quality.

*Yellow Soap* consists of a mixture of any hard fatty soap with a variable proportion—up to 40 % or more—of resin soap. That sub­stance by itself has a tenacious gluey consistence, and its inter­mixture in excess renders the resulting compound soft and greasy. The ordinary method of adding resin consists in stirring it in small fragments into the fatty soap in the stage of clear-boiling; but a better result is obtained by separately preparing a fatty soap and the resin soap, and combining the two in the pan after the underlye has been salted out and removed from the fatty soap. The compound then receives its strengthening boil, after which it is fitted by boiling with added water or weak lye, continuing the boil till by examination of a sample the proper consistency has been reached. On settling the product forms three layers: the uppermost is a thin crust of soap which is worked up again in the pan; the second is the desired soap; next there is a dark-coloured weak soap termed nigre, which, because it contains some soap and alkali is saved for future use; underneath these is a solution of alkaline salts with a little free alkali.

*Treatment of Settled Soap.—*The upper layer having been removed, the desired soap is ladled out or ran off to a crutcher, which is an iron pan provided with hand or mechanical stirring appliances. It is here stirred till it becomes ropy, and the perfume, colour or any other substance desired in the soap is added. The soap is now ready for framing. The frames into which hard soaps are ladled for cooling and solidification consist of rectangular boxes made of iron plates and bound and clamped together in a way that allows the sides to be removed when required; wooden frames are used in the case of mottled soaps. The solidification is a very gradual process, depend­ing, of course, for its completion on the size of the block ; but before cutting into bars it is essential that the whole should be set and hardened through and through, else the cut bars would not hold together. Many ingenious devices for forming bars have been pro­duced; but generally a strong frame is used, across which steel wires are stretched at distances equal to the size of the bars to be made, the blocks being first cut into slabs and then into bars.

*Marine Soap.—*These soaps are so named because they are not insoluble in a strong; solution of salt; hence they form a lather and can be used for washing with sea-water. Being thus soluble in salt water it cannot, of course, be salted out like common soaps; but if a very concentrated salt solution is used precipitation is effected, and a curd soap is separated so hard and refractory as to be practically useless. Coco-nut soap (see above) is typical of this class. Its property of absorbing large proportions of water, up to 80 %, and yet present the appearance of a hard solid body, makes the material a basis for the hydrated soaps, smooth and marbled, in which water, sulphate of soda, and other alkaline solutions, soluble silicates, fuller’s earth, starch, &c. play an important and bulky part. Coco­nut soap also forms a principal ingredient in compound soaps meant to imitate curd and yellow soaps. Two principal methods of prepar­ing such compound soaps are employed. In the first way the ordinary oil and the coco nut oil are mixed and saponified together as de­scribed above. According to the second plan, the ordinary oil is treated as for the preparation of a curd soap, and to this the coco­nut soap separately saponified is added in the pan and both are boiled together till they form a homogeneous soap.

*Silicate Soaps.—*A further means of enabling a soap to contain large proportions of water and yet present a firm consistence is found in the use of silicate of soda. The silicate in the form of a concen­trated solution is crutched or stirred into the soap in a mechanical mixing machine after the completion of the saponification, and it appears to enter into a distinct chemical combination with the soap. While silicate soaps bear heavy watering, the soluble silicate itself is a powerful detergent, and it possesses certain advantages when used with hard waters.

*Soft Soap.—*Soft soaps are made with potash lyes, although in practice a small quantity of soda is also used to give the soap some consistence. There is no separation of underlyes in potash soap, consequently the product contains the whole constituents of the oils used, as the operation of salting out is quite impracticable owing to the double decomposition which results from the action of salt, pro­ducing thereby a hard principally soda soap with formation of potassium chloride. Owing to this circumstance it is impossible to "fit ” or in any way purify soft soap, and all impurities which go into the pan of necessity enter into the finished product. The making of soft soap, although thus a much less complex process than hard soap making, is one that demands much skill and experience for its success. From the conditions of the manufacture care must be taken to regu­late the amount and strength of the alkali in proportion to the oil used, and the degree of concentration to which the boiling ought to be continued has to be determined with close observation.

*Toilet Soaps*, &c.—Soaps used in personal ablution in no way differ from the soaps previously alluded to, and may consist of any of the varieties. It is of consequence that they should, as far as possible, be free from excess of alkali and all other salts and foreign