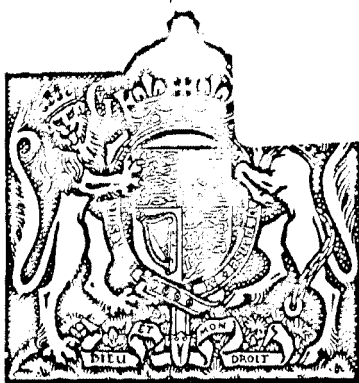


THE MANUFACTURE OF GRAINED SOAP
ON A LARGE SCALE WITH THE HELP OF
STEAM AND MECHANICAL APPLIANCES.

By

R. L. Datta & T. Basu.



Government of Bengal
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The manufacture of Grained Soap
on a large scale with the help of
steam and mechanical appliances

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The manufacture of grained soap on a large scale with the help of steam and mechanical appliances.

Considerable quantities of grained soap are made and sold in Bengal in the moulded form for use in the household and the laundries. The usual shape of this soap is that of the earthenware cup used as the mould. The soap is in most cases mixed with soapstone, soda silicate and soda ash. The varying degrees of filling generally found in this soap make it very uncertain to the consumer, and as the soap is more or less a lump in form, the name or brand of the maker of a standardised product cannot be established. The great partiality for this soap shown by the *dhobis* and the general public is based on the right belief that this soap is economical in use as it is sold in a highly concentrated form, i.e., it contains much less water than any other soap made by the boiling process.

2. As compared with the soap made by the fitting process which is largely in use in manufacturing washing soaps of superior quality, the graining process has another distinct and important advantage inasmuch as the entire charge of oils and fats is in this process directly converted into a clean soap without the production of any inferior soap like the "nigre" which is formed in the former process.

3. With a view to standardise the product and to make possible the establishment of reputation for quality of particular makes, it was shown in our earlier publication, "On the framing and stamping into tablets of grained soap usually moulded in pots" (Bulletin No. 45), that this soap can be framed and cut into the required size and stamped in any standard stamping press, so that the soap can be presented to the public in an attractive and suitable shape on which the consumer can rely for correct soap-value consistently with the reputation of the maker and the price paid.

4. The manipulations which the manufacturer of moulded soap is, in pursuance of the existing process, obliged to carry out by hand necessarily restrict the size of the pan he can use for boiling and graining the soap. In making moulded soap, the worker has to stand by the side of the pan containing the grained soap and bend over its edge to work up the soap with a hand trowel and remove it for moulding in earthenware cups, or, as we have already shown (*loc. cit.*), for cooling in frames. It may be seen that for the carrying out of this operation the pan must be of such a size that all the removable soap can be reached and worked by the worker with his hand. Experience shows that a 38" deep pan with a proportionate diameter and having a somewhat straight side is about the maximum size that can be used for the above purpose, and as only a few inches of soap are formed in a pan of this size, the output of soap per pan cannot be much. This is a serious drawback for factories requiring a high output, as they have at present no alternative other than the multiplication of units, which takes up considerable factory space and requires the employment of a large number of operatives. Further, it entails considerable cost on fuel for the small, direct-fired pans are notorious for their excessive fuel consumption. These factors necessarily increase the cost of production to a great extent.

5. It has already been mentioned that much importance is attached to the grained soap in Bengal, and many soap factories in this province occupy themselves in turning out large quantities of this soap in the moulded form. These facts made it desirable to undertake an investigation into the possibility of adapting this manufacturing process to operations on a large scale, improving the quality of the product, and finally, bringing down the cost of manufacture. The experience gathered from experiments since conducted with the above ends in view shows that the substitution of direct fire by steam in soap boiling and graining, and of the hand trowel by mechanical crutcher in the working up of the neat soap are steps which make possible the achievement of the above objects. The use of a large steam-heated pan in the place of a number of direct-fired pans of a small size not only results in considerable saving in fuel and labour but also ensures a better product for the considerable darkening of colour of the soap caused by strong and unequal heating in direct-fired pans is altogether got rid of.

6. It is the object of the present bulletin to indicate the precise details of manipulation and of the plant that is to be used for the purpose set out in the last paragraph. It will incidentally be seen that a large amount of labour can be saved by operating on a sufficiently large scale and making use of gravity for the transference of the hot soap. For a given output, the work of scores of men may now be done by only a few hands.

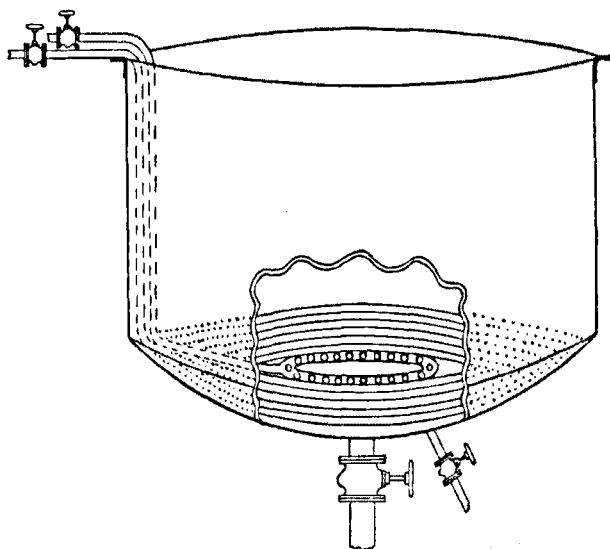
7. For a clear understanding of the plant and its operation, the method of making grained soap may be divided into four stages as follows:—

- (i) Saponification.
- (ii) Graining.
- (iii) Crutching, i.e., stirring or kneading into a homogeneous mass
- (iv) Framing.

8. The saponification and the graining may be done in separate pans, or in the same pan. If separate pans are used, the one for saponification should be the usual deep type pan, cylindrical or square, and heated by means of direct and indirect steam. The graining of necessity has to be done in a shallow pan, the diameter of which should be about $1\frac{1}{2}$ the depth, and the pan is to be heated by indirect steam only. The use of separate pans for saponification and graining necessitates the transference of soap from the saponification to the graining pan, and this can be done with the help of gravity by placing the saponification pan at a higher level, or it may be done by pumping the soap from the saponification to the graining pan if both are on the same level.

9. It has, however, been found convenient to perform both the operations of saponification and graining in one and the same pan. The pan must in this case be of the shallow type which will be suitable for graining and will also do for saponification. The heating arrangement of the pan should be by means of both direct and indirect steam coils. During the saponification both direct and indirect steam, and during the graining the indirect steam only, can be used. The extent and intensity of the indirect steam coil should be such as to make the soap boil whenever necessary without the assistance of direct steam. The necessity of having a shallow pan lies in the fact that the contents of a deep pan will not grain normally in proper time by means of indirect steam alone.

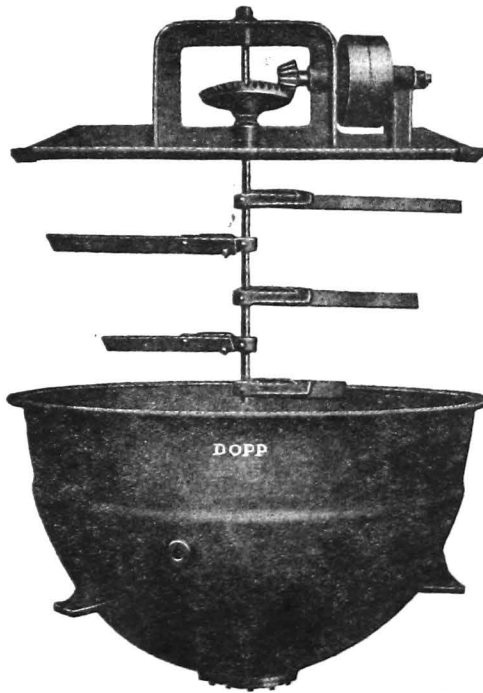
10. The pan with the most suitable proportions to answer the requirements of graining as also of saponification has been found to be that the diameter of which is one and a half times the depth. The pan should be slightly rounded at the bottom, the entire bed of which should be covered with the indirect steam coil. At the centre of the bottom there should be a short direct steam coil with perforations on all sides. The sketch of a typical plant of this description is given below.



In this pan both the direct and the indirect steam can be used during the saponification, while during the graining the direct steam should be completely shut off, and the operation proceeded with the indirect steam alone. It is obvious that with such a pan made of sheet iron, and with iron coils for steam, there can be no limit to the size and the pan can be made as large as those in use in the biggest soap factories for the making of fitted soap. The actual process of saponification of oils and fats can be carried out in this pan according to the standard method of soap manufacture. For a detailed account of the process of graining, however, our earlier work (Bulletin No. 45) may be consulted.

11. Another class of steam-heated pan suitable for the present purpose is the shallow type of hemispherical steam-jacketted kettle of cast iron made by firms like the Sowers Manufacturing Co., Buffalo, New York, U. S. A. Apart from being expensive, the drawback of this type of pans is that on account of large castings involved, they are not made of sizes of more than 8,000 lbs. capacity, necessarily limiting the magnitude of operations. A further drawback is that both the saponification and the graining have to be carried out by indirect steam, the saponification process accordingly consuming more steam than when conducted in the steam-coil pans where direct steam can be used. Besides, the efficiency of steam is greater in steam coils immersed in the soap mass than in the jacket. But such a pan has this notable advantage that it can be used for three purposes successively, viz., the saponification, the graining and the crutching. The last named process will be described later on.

12. The steam-jacketted pan of which the following is an illustration is a seamless one, being cast in a single piece.



It is jacketted up to about two-thirds of its height from the bottom. The jacketted portion is made sufficiently strong to withstand fairly

high pressure. The sides of the pan are, therefore, of considerable thickness and the pan in consequence is much heavier than a sheet iron pan of the same size. There are inlets for steam on the sides of the jacket and an outlet for steam and condensed water at its bottom. There is a cast-through outlet at the bottom for drawing off the contents of the pan. The working of the jacketed pan is very simple. The heating can very well be controlled by regulating the flow of steam into the jacket.

13. After the graining operation, the soap is to be allowed to settle its lye and then crutched mechanically into a homogeneous mass. Both these operations are carried out in the crutching pan. As soon as the graining is complete, the soap is transferred over channels assisted by gravity, or pumped into the crutching pan which consists of a deep round-bottomed cylindrical tank of sheet iron, having an outlet at the bottom large enough to empty it quickly and provided with a mechanical stirring or crutching gear. The size of the crutching pan shall be such as to be able to take the entire charge of grained soap of the original pan. As the saponification and graining may take more than two days, a single crutching pan will suffice to handle the output of two or more regular saponification and graining pans. After transference, the soap in the crutching pan is allowed to stand, preferably overnight, to effect a proper settling of the lye. The separated lye is next drawn off, leaving only the neat soap in the pan. The crutching gear is now put into operation and the soap crutched for 10 to 15 minutes, depending on the character of the soap, until a homogeneous soap mass is obtained. The soap is thereafter run directly into frames placed below the outlet. In the frame a slow rate of cooling is necessary for a further disengagement of the lye before the setting of the soap takes place. The more thorough the elimination of the lye, the lower the salt content and the better the body of the soap. The frames may be large or small. The large ones may be made of iron as the soap in a large mass takes a long time to cool. The small frames, however, shall be made of wood.

4. If the steam-jacketed kettle is used for the saponification, it can very conveniently be used for the crutching as well, for such pans are provided with crutching gear which can easily be taken out of the pan when not required for use, as during the saponification and the graining. After the properly grained soap has settled lye overnight, the latter is drawn off, leaving the soap alone in the pan. The stirring gear is now lowered into the soap mass, worked as described above, and the soap run into frames.

15. The arrangement of the whole plant should be such as to enable the transference of the soap in the successive stages of the operation being done, as far as practicable, with the help of gravity. The saponification and graining pan can, however, be placed in the same level with the crutching pan, but the transference of the soap from the former to the latter will in that case have to be done by means of a pump. It is essential, however, that the crutching pan shall be placed at some height from the floor so that the crutched soap can be quickly discharged into the frames placed underneath without any intermediate cooling taking place.

16. A high colour is generally regarded as a mark of inferiority of the soap. The mechanical and large scale handling of grained soap

with the help of steam, however, ensures greater paleness of colour of the product than what is possible by the direct fired pans now in vogue. It also enables the production of a soap containing, as already mentioned, much less salt than what has hitherto been possible by following the existing process. As salt in soap usually carries with it small quantities of free alkali, the less the quantity of salt, the less the free alkali. Hence, a soap approaching the degree of neutrality common to the fitted soap is possible of achievement by this method. In the case of the fitted soap the excess of alkali is frequently neutralized by mixing with the soap calculated quantities of fatty acids. A similar procedure may, with equal effect, be followed in the case of the grained soap at the time of crutching.

17. In order to give an idea as to what a profound influence the mechanical handling and the large scale operation may have on the salt-content and, therefore, the purity of the grained soap, the following experimental results are reproduced:—

Description of soap.	Salt content.
Moulded by hand in earthenware cups	... 4.50 per cent.
Crutched by trowel and framed	... 2.01 per cent.
Crutched mechanically and framed	... 1.31 per cent.

The last of the above results, viz., 1.31 per cent. salt, was obtained by working in small masses only and the value is about the same as is obtained in fitted soap made in large-ratio pans, i.e., pans of a relatively small size for a big factory but still of a much larger size than our experimental pans. It is expected that the salt-content of the grained soap will be lower in large pans as is the case with fitted soap.

18. To sum up, the results of our investigations go to show that so far as the salinity and neutrality of the products are concerned the graining process is on a par with the fitting one. The former has, moreover, this additional advantage that it separates no nigre, the entire charge of oils and fats being transformed into and made available as a complete soap of a very high concentration and excellent detergent properties. The process as worked out is ready for adoption as the standard process suitable for operation on as large a scale as desired.

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