

**GOVERNMENT OF INDIA**  
**DEPARTMENT OF INDUSTRIES AND SUPPLIES**



**Report  
OF THE  
PANEL ON GLASS  
INDUSTRY**

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## SUMMARY OF RECOMMENDATIONS.

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सत्यमेव जयते

## INTRODUCTION.

The Glass Panel was constituted by the Government of India, Department of Planning and Development, to recommend to the Government such steps as are considered necessary for the development of the Indian glass industry and particularly to lay down targets which should be reached within five years and also to recommend the measures to achieve these targets. The Panel was constituted of the following :—

- Mr. I. D. Varshnei (Chairman),  
Managing Agent, U.P. Glass Works, Ltd., Bahjoi, (U.P.).
- Mr. S. P. Ogale, (Member).  
Proprietor, Ogale Glass Works, Ltd., Ogalewadi, Satara (S.I.).
- Mr. R. D. Chandorkar, (Member).  
Managing Director, Vijay Glass Works, Mazagaon, Bombay.
- Dr. A. Nadel, (Member),  
Glass Technologist to the U.P. Government, Cawnpore.
- Dr. Atma Ram (Member).  
Officer-in-charge, Central Glass and Ceramic Research Institute,  
Jadavpore, 24, Perganas, Bengal.
- Mr. D. N. Sen, (Member),  
Managing Director, New India Glass Works, Ltd., Calcutta.
- Mr. Sridhar, (Member).  
Proprietor, Messrs. Bishambar Dayal Shriniwas, Bangle Manufacturers, Firozabad. (U.P.).

At a later stage Mr. K. C. Roy, Manager, The Bengal Electric Lamp Works, Ltd., Calcutta, was co-opted as a member of the Panel.

2. Mr. S. Datta was appointed as the Secretary. After his death, Mr. A. K. Datta was appointed to act as Secretary to the Panel.

3. The Panel was given a General Directive to aid its deliberations. The Panel has regarded this more as indicating the several aspects of the industry on which it should particularly express its opinion, rather than as completely limiting its scope of work.

4. In order to assist the Panel to formulate its recommendations, the Secretary, late Mr. Datta prepared a comprehensive factual note surveying the present position of the industry. Two questionnaires were issued in order to elicit the opinion of the manufacturers, dealers, consumers and other relevant parties. With a few exceptions, the response to the questionnaires has been generally good. The Panel held a number of meetings at important centres connected with the industry and invited representatives of industry, importers and Government departments for oral evidence, notes and discussions. Meetings were held at the following places:—

1. Delhi—23rd April, 1945.
2. Bombay—21st to 25th August, 1945.
3. Calcutta—12th to 15th November, 1945.
4. Firozabad and Delhi—7th to 9th January, 1946.
5. Delhi—29th and 30th April, 1946.

6. Delhi—19th August, 1946.

7. Delhi—1st November, 1946.

5. The Panel visited some factories and arranged discussions which have been very helpful to it in formulating its recommendations and confirming its findings.

6. The report is divided into two parts. Part I deals with the present position of the industry and other important aspects relating to its early development, organisation, location; imports, present production, causes of backwardness and so on. In Part II, the Panel makes recommendations with respect to targets of production, scope of development and other important aspects and records its replies to the points raised in the General Directive.

7. At the outset, the Panel records that during the enquiry, it has been constantly impressed by the fact that the manufacturers have invariably raised the question of the existing system of control of raw materials and their distribution, which they regard as one of the chief impediments in the way of improving the quality of production and of development of the industry. In the report, however, the Panel has assumed that these wartime measures will cease to exist and handicap the industry as during the war. The Panel believes that such an assumption is essential if we are to make plans for the development of the industry.

8. The Panel expresses its appreciation of the sustained and sincere efforts made by the late Mr. Datta for the success of this work. It is most unfortunate that his premature death denied the Panel of his valuable services at the time of drafting the report. Another severe loss from which the work of the Panel has suffered, has been the premature death of Mr. K. C. Roy, who was mainly responsible for most of the information supplied to the Panel on the electric bulb industry. The Panel also places on record its appreciation of the valuable services rendered by the new Secretary, Mr. A. K. Datta, in the reporting and concluding stage of the Panel's work. The Panel also wishes to acknowledge the help and co-operation which it has generally received from various parties in the course of its work. But it is difficult to mention the various parties here individually.

9. The Panel now begs to submit the following report to the Government of India through the Industrial Adviser.

(Sd.) I. D. Varshnei, (Chairman).

S. P. Ogale.

R. D. Chandorkar.

D. N. Sen.

Snidhar.

Atma Ram.

\*A. Nadel.

A. K. Datta.  
SECRETARY.

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\*Dr. Nadel was out of India at the time of final signature.

## PART I.

### EARLY DEVELOPMENT OF THE INDUSTRY.

10. It will be useful to start the Report with a short historical background of the development of the glass industry in India and the hard and continuous struggles which it faced in its early pioneering days. Glass manufacture in India on modern lines dates from the 90's of the last century when a bottle factory was started at Jhelum by the Murree Brewery with the help of a German expert. This venture was short-lived but it was followed by the starting of a number of other glass factories which were set up with the help of foreign technical experts. All these scattered attempts to start the glass industry in India, however, did not lead to the establishment of the industry on a solid and permanent basis. In fact, it has been estimated that over half a crore of rupees had been sunk and lost in these early attempts. With the outbreak of Great War I, however, imports from the European countries were cut off and thus a powerful impetus was imparted to the glass industry in India. The older units increased their output and new factories were started to take advantage of the war situation. Nevertheless, apart from bangles, in spite of best efforts, domestic production could meet only a small part of our total requirements and that again only in respect of ordinary blown-ware and some pressed ware. Simultaneously with the expansion of the industry in India, again, Japan which was steadily building up a well-organised glass industry based on mass production methods, seized the opportunity and captured a very substantial part of the market in India where it had almost no foothold before the war.

### PROGRESS IN FOREIGN COUNTRIES.

11. In order to analyse clearly the causes of stagnation in the Indian glass industry, it will be profitable to see how this industry developed in other countries during and after Great War I. The condition of the glass industry in some of the European countries at that time was far from satisfactory. For instance, in England a considerable portion of her requirements, particularly in regard to optical and scientific glassware, was supplied principally by Germany and Austria which were at that time sufficiently advanced in the technique of glass manufacture. Two of the important developments during the inter-war period which materially influenced the growth of the industry in these foreign countries were:

- (a) the organised application of scientific methods in the industry; and
- (b) the increasing interest taken by the State in developing and fostering the industry.

It was during this period that the Department of Glass Technology was started under Professor W. E. S. Turner of Sheffield, which has been responsible for much of the great technical development in this industry. Simultaneously, the glass industry was being increasingly mechanised, the wartime shortage of labour having given a stimulus to the process. As a result, the entire character of the industry underwent a fundamental change. In this process of progressive mechanisation, America contributed very largely. The introduction of machines had a very great influence on every branch of glass manufacture, such as the type and size of furnace, the kind of fuel used, the type of raw materials, etc. It also altered the locational factors of the industry inasmuch as it was no longer absolutely essential to locate factories in the areas guaranteeing the availability of skilled glass workers. Again, due to the difficulties which the Government experienced during the war while the normal sources of supply of

vital and strategic glassware were cut off, the Government realised as never before the importance of actively developing this industry which was essential alike in peace and war. The State came forward to help the industry by giving it protection against unfair foreign competition in the form of tariff, subsidies, etc., and by financially and otherwise assisting in the establishment of technological institutions, research associations and industrial organisations on sound lines.

#### CONDITION IN INDIA.

12. In contrast, the circumstances which the Indian industry had to face were very difficult and adverse. Unlike that in other advanced countries, the Government did not come forward to assist the industry in spite of clear warnings. As late as 1931, after several representations from the glass industry since 1927, the Government referred its case for protection to the Tariff Board. The Board critically examined the different aspects of the glass industry and recommended the granting of protection and the establishment of a Government technological institution for helping the industry. The Government, however, turned down these proposals mainly on technical grounds. The case for the State coming forward to aid the industry has been very succinctly put by Sir A. Chatterton in the *Indian Munitions Handbook* thus:—

“The Glass industry has come to stay but without aid from the state, it is likely to make very slow progress in the future”.

The Industrial Commission (1916) also stated that ‘to establish a tariff and then to trust to private efforts is not likely to be productive of satisfactory results. Clearly, the State should take the lead, employ experts and place them in charge of practical works’. Unfortunately in India the State has been lagging in appreciating its responsibilities for helping the development of this important industry.

13. So far in regard to the patronage of the State. With regard to technical development also, we find that the Indian industry has been sadly lagging behind. As early as 1908 the Paisa Fund Glass Works training centre was established with the help of Mr. I. D. Varshnei who had received foreign training in glass technology, for teaching students in the practical art of glass manufacture. The industry, however, is established partly on the basis of cottage industry and partly on that of large scale industry. The size of the average factory is not very large and the number of factories with capital exceeding a few lakhs, is comparatively very small. During the war, there has been some tendency on the part of some financiers to come into the glass bangle industry. Although the workers have been derived mostly from the local artisan class, the management has in some cases been in the hands of financiers. The industry, again, is often run like a family concern by people who learnt the art of glass manufacture and themselves became in many cases the organisers *cum* technicians. Many of the well-known factories such as the Ogale Glass Works, Vijay Glass Works, etc., are like this. With the outbreak of the war, enterprise and capital from outside flowed into the industry and today while some of the factories are being run as proprietary concerns, others are run as limited companies on the managing agency system. The glass industry in this country thus represents diverse types of industrial organisation, varying from cottage industry to large scale units controlled both by proprietary and managing agency systems. Recently, there has been another healthy trend, *viz.*, the establishment of a number of factories, some of them of appreciable size, in the Indian States.

## TYPES OF ARTICLES PRODUCED.

14. The types of articles at present produced by the Indian Glass Industry can be classified under the following heads:—

- (1) Bangles.
- (2) Hollow-ware, including lamp-ware and table-ware.
- (3) Bottle-ware.
- (4) Sheet glass.
- (5) Pressed-ware and fancy goods.
- (6) Other varieties including scientific glass-ware, rods, test tubes, acid carboys, thermoflasks, glass shells for electric bulbs, etc.

The following review summarises the position of the several branches of the glass industry.

### (1) *Bangles*:—

15. The bangle industry is one of the most developed branches of the Indian Glass Industry. It is concentrated in the small town of Firozabad where the entire population of nearly 40,000 is directly or indirectly connected with the bangle trade. The art of glass bangle making by hand as practised by the *Shishgars* of Firozabad has reached a fairly high state of efficiency through its century-old traditions. There has been an increasing use of locally made appliances for drawing the bangles in the form of spirals (varying from 100 to 200 circlets in a spiral). But here again, it is the skill of the workmen that largely contributes to the success of the operations. From the production of glass to the final stage of finished bangle, there are several processes which are seldom completed in the same factory and are usually done by different people skilled in the particular art. Some of the auxiliary materials (such as liquid gold and china glass) have been produced in this country by methods worked out at the laboratories of Industrial Research Bureau (now the Council of Scientific & Industrial Research). Bangles are produced in a variety of brilliant colours and are made by several processes. It is necessary to mention that the compositions that are used for producing the bulk glass for the bangles have mostly been evolved by the trial and error methods, after years of work. Those compositions are consequently regarded as trade secrets and are jealously guarded. In view of this and the great advance that has been made both in the composition and the technique of production of coloured glass, a great deal can be done for improving the production of coloured glasses for the manufacture of bangles.

16. The bangle industry has undergone great expansion during the war mainly on account of the stoppage of import from Japan and Czechoslovakia, the two principal exporters of glass bangles to India. The scarcity of chemicals and coal had been all the more acute in the case of this industry, since it was classified as an industry not associated with war efforts. The Glass Industrial Syndicate, Firozabad, estimates the total daily output to be about 80 tons a day valued at nearly Rs. 1,40,000, or an annual production of about 18,000 tons valued at over Rs. 3 crores. The growth in the number of factories and volume of production during the war years shows that in spite of a heavy increase in the cost of fuel, chemicals and labour and other wartime difficulties, the Firozabad bangle industry has been able to work on a satisfactory margin of profit. Considering the total amount of glass produced in the bangle industry, the improvement in the construction of furnaces for producing even the



the bangle industry, both in its operation and in its organisation, differs considerably from other branches of the industry and deserves special considerations.

(2). *Hollow-ware*:—

17. The production of hollow-ware like tumblers, hurricane globes, lamps, chimneys, jugs, etc., is now carried on on a fairly large scale and the indigenous industry employing mechanical methods has been able to cope with the entire growing demands of the domestic market. The importation of these articles had almost entirely stopped during the war years. Even before the outbreak of the war, the Indian made hurricane lantern globes could compete effectively with the standard imported articles. In fact, from the oral evidences given before the Panel by several dealers, it has been established that the Indian made hurricane globes were actually being sold in India under some well-known foreign trade names. Even blown articles such as tumblers have been produced in quite large numbers and the products of some of the factories can stand comparison with the standard imported articles. Judging from the experience gained by the Indian manufacturers in the production of hollow-ware articles over more than three decades and from their ability to meet the war-time demands, it is reasonable to expect that the Indian factories will be able to cope with the entire demand of the internal market provided the finish of the articles is further improved—a consideration which is a determining factor in ensuring marketability. Mechanisation has not, however, yet made much progress in the industry.

(3) *Bottle-ware*:—

18. In every country the production of glass containers constitutes a very substantial part of the total production of all glasswares. In India before the present war, however, progress in this line, considering the requirements of the country, had been rather meagre. The indigenous articles could not compete with the imported products on account of their poor finish and quality, irregular capacity and in some cases low chemical or mechanical resistance which made them unsuitable for use by chemical manufacturers and Excise Departments. The production of bottles during the war has increased several fold and a number of factories of fairly big sizes have been started in different parts of the country. In a majority of the factories, bottles of various sizes and types are now made by hand-operated machines working on tank furnaces with a capacity varying from 1 to 15 tons. Annealing of the bottles is done in annealing kilns of the old pattern but in some new bottle factories equipped with tank furnaces, some automatic machines and annealing lehrs have been recently set up. Although there are no reliable estimates of the total quantity of bottles manufactured in the country, it appears from the answers to the questionnaires and the evidences of important producers, dealers and consumers that to-day enough bottles are made in Indian factories to meet the entire demand of the Indian market. Fancy bottles required particularly in the chemical and perfumery trade have also been produced but they have not yet attained the standards of imported articles. To some extent this may have been due to the non-availability during the war of important chemicals of right quality for such types of glassware. Nevertheless, it has to be admitted that a great deal of effort is needed to produce fancy bottles of the requisite standards before one can expect them to meet the Indian requirements which are growing in view of the increased production of perfumery and toilet articles in India.

(4) *Sheet Glass* :—

19. Before the War sheet glass was manufactured only in one factory in India (The U.P. Glass Works, Ltd., Bahjoi). During the war, the demand for sheet glass greatly increased and two more sheet glass factories were started to meet the increased demand, viz., the Seraikella Glass Works, Ltd., at Kandra in Seraikella State near Jamshedpur and the Sodepur Glass Works, Ltd., at Sodepur, Bengal. All the three factories work on the Fourcault process using regenerative tanks. According to the figures collected from these factories, the total annual production of glass sheets is now about 13 million square feet and the total rated production capacity is 20 million square feet. The production capacity of these factories is being increased considerably and it is expected that it would soon reach the figure of 30 million square feet. Before the outbreak of the war, the total import of sheet and plate glass was nearly 25 million square feet, including figured and plate glass. The figures for figured and plate glass are not shown separately in official statistics but it is estimated that they amounted to approximately 3.4 million square feet. The total consumption of sheet glass in India was therefore 22 million square feet of import plus the output of the U.P. Glass Works of 6 million square feet, that is to say, a total of 28 million square feet.

(5) *Pressed-ware* :—

20. A small quantity of pressed-ware consisting chiefly of small dishes, jars, inkstands, plates, paper weights and tiles, etc., is produced in the country mainly by hand process. The total production of pressed-ware is very small and the quality leaves much to be desired.

(6) *Beads and False Pearls* :—

21. Beads and false pearls constituted a very big item of import of glass articles in India before the war. Crude varieties of beads known as cattle beads are produced as a cottage industry in a few centres in northern U.P. A training centre was started at Benares by the Glass Technology Section of the Department of Industries (U.P.) for training workers in the manufacture of beads. Some of the trainees later on set up small and independent working units; the U.P. Government granted them some financial assistance in setting up such units. Present production which is mainly confined to U.P. is still very small and is inadequate to meet the total requirements of the country.

(7) *Scientific Glassware* :—

22. The production of scientific glassware is an important although an entirely new development in our country. With the outbreak of the war and the difficulty of importation due to shipping difficulties and also the increased requirements of the exporting countries, there was an acute shortage of scientific glassware in India. Several factories which were not previously working in these lines started the manufacture of scientific glassware to meet the urgent requirements of the Indian market and some of them have already succeeded in putting on the market good and satisfactory articles. Considerable experience in this line has been gained by the Indian manufacturers during the war, but a great deal of improvement in quality and precision would be required before the industry can establish itself on a sound footing.

(8) *Optical Glass* :—

23. Optical and scientific instruments have been manufactured at the Mathematical Instruments Office, Calcutta, for long but until recently, they were mainly manufactured in small quantity or as individual instru-

ments to meet special requirements. After the outbreak of the war, the requirements of the Master General of Ordnance increased enormously and in 1941 manufacture of optical instruments in much greater volume was undertaken in India, under the direction of the Director General, Munition Production (Ordnance Factories Division). In addition to the capacity existing at the M.I.O., a new factory was erected at Dehra Dun to meet the requirements of large production of optical and scientific instruments. These two factories manufactured a large range of optical instruments during the last five years, all from imported blank but not from raw material. It is understood that certain commercial firms have now also established manufacture of optical instruments other than those of an exacting nature of high degree of accuracy. The production of optical glass and optical instruments has many aspect peculiar to its own. Glass of the highest quality is used. The problem of the optical glass industry is not entirely that of glass production but has a great deal to do with the manufacture of scientific instruments.

(9) *Glass shells for electric lamps:—*

24. The manufacture of glass shells for electric lamps is a recent development in India. Before the War, the Indian electric lamp manufacturers had to import all the glass shells required for the manufacture of bulbs. The Bengal Electric Lamp Works, Ltd., started production on a small scale in 1938 and until 1942 they were the only firm producing glass shells in India but they themselves consumed their entire output. When imports were curtailed, the electric lamp manufacturers found it difficult to obtain glass shells from abroad. At the instance of the Supply Department, the production of glass shells was, therefore, developed in the U.P. by Kaysee Glass Works Ltd., and the Ganga Glass Works, Ltd., and in Calcutta by Shree Govinddeo Glass Works, Ltd., Shree Hanuman Glass Works, Ltd., and the New Indian Glass Works, Ltd. Later on two other firms in Calcutta, viz., the Electric Lamp Manufactures (India), Ltd., and Messrs. Calcutta Glass and Silicate Works, Ltd., were started in 1945 to manufacture glass shells. It was estimated that in 1945 the production of glass shells reached the figure of 10 millions. The development of this branch of the glass industry has made the Indian electric lamp manufacturers largely independent of foreign imports in respect of glass shells. The method of production, however, is not dissimilar to that of the mouth blown ware. Annealing of the shell is carried on in specially designed annealing lehrs. The composition of glass, however, varies from factory to factory.

#### PRESENT LEVEL OF PRODUCTION.

25. In the absence of proper data, it is very difficult to estimate with any degree of accuracy, the present output of glass and glass-ware in India, as well as the production capacity of the glass factories. The Indian Tariff Board was confronted with the same difficulty and all estimates so far made, have been based on the estimated total capacity of the works and the assumption of the number of working days in the year. Recently an attempt was made by the Director General of Commercial Intelligence and Statistics to publish monthly statistics of production of glass factories in India. Accordingly he sought the co-operation of the Provincial Departments of Industries and glass manufacturers, but after a few months, the project had to be abandoned "on account of the lack of co-operation on the part of glass manufacturers in India". The is certainly very regrettable, because the maintenance of proper statistics is as much in the interest of glass manufacturers as of the Government Departments.

The Panel feels that now with the organisation of the all-India Glass Manufacturers' Federation which represents the bulk of the glass factories in India, it should be possible to take up this work again.

26. With a view to collecting more reliable and accurate data, a questionnaire was issued by the Panel, but the replies from all the factories have not been received yet and it is quite possible that some of the factories are unwilling to disclose their actual production figures and some may have supplied figures of the capacity of the furnaces rather than of actual production. When the Indian Tariff Board commenced their enquiries in 1931, they estimated the value of indigenous manufacture of various types of glassware as follows:—

				Rs.
Bangles	..	..	..	1,15,00,000
Bottle-ware	..	..	..	6,50,000
Lamp-ware	..	..	..	16,00,000
Sheet glass	..	..	..	2,50,000
Total				1,40,00,000

Later estimates show an appreciable increase in the output of the different varieties of glassware (other than bangles) over the estimates of the Tariff Board in 1931. Mr. Dixon estimated in 1935 the value of blown glassware produced in India as Rs. 36.5 lakhs per annum. But the Glass Technologist to the U.P. Government estimated the total value of pre-war production of glass and glassware in India as Rs. 120 lakhs per annum of which glassware other than bangles accounted for Rs. 40 lakhs. Dr. P. J. Thomas in his report put the value of annual production immediately before the War at Rs. 200 lakhs. This production met the bulk of the Indian requirements for glass bangles, but met only 30 to 40 per cent of the requirements of glassware other than bangles consumed in the country.

27. The value of production in terms of money would, however, be misleading unless we can compare the actual tonnage of production during different periods. The Glass Industrial Syndicate of Ferozabad estimated that the daily production of glass bangles is about 80 tons valued at Rs. 1,30,000. Making allowance of 25% on 300 working days per annum, the total production of the bangle industry alone thus amounts to at least 18,000 tons valued at Rs. 3 crores. Another way of estimating the tonnage of production would be by way of the known amount of soda ash required for the glass factories, which had been released to the industry by the Government during the War. Assuming that the glass produced in the Indian factories contains on an average 18% of sodium oxide and that all the soda ash released has been used in the production of glass, the total quantity of glass melted may be taken to be about 70,000 tons (the quantity of soda ash released during 1944 being 21,000 tons). It is true that some of the factories have utilised quite a large amount of cullet for making glass articles and a certain amount of soda ash may have been obtained by the glass industry from sources not covered by the release. Moreover allowance must be made for wastage and breakage. Taking all these factors into consideration, the Panel is inclined to believe that the total production of glass articles, in terms of tonnage, was not more than 1,00,000 tons. From the answers to the questionnaire issued by the Panel, the total quantity of glass melted in glass furnaces could be put at 150,000 tons. This is probably an over-estimate. At the same time, it should be mentioned that on account of the great transport difficulties experienced by the glass industry during the War, the industry could not get enough raw materials and was probably working under capacity for some time.

## REVIEW OF TRADE.

28. Statistical data relating to the trade of India in respect of glassware are adduced in Statements No. 2 and 3 given in the appendix. It would be seen that in ten years Japan's quota had risen from nearly 30 to 50% of our imports, a most remarkable increase being in the case of bangles, bottleware, scientific glassware and sheets and plates. It would also appear from the tables that after Great War I, Japan succeeded in capturing a good part of our market and obtained a firm foot-hold here. The peak imports were in the year 1920 (more than Rs. 3 crores) and in spite of the encouragement that the domestic industry received from the Swadeshi movement, the import of glass articles remained quite substantial amounting to about half of the total value of Indian requirements. Again in the case of certain items like plate glass, beads, false pearls, etc., almost the whole of the Indian requirements were met by import. India had also developed some export trade with some of the neighbouring countries such as Aden, Malaya, Iran, Ceylon, etc. During the recent War, when the major exporting countries were unable to supply the requirements of these neighbouring countries, India had an excellent opportunity of capturing this export market. However, on account of the non-availability of essential raw materials and shipping facilities the opportunity went grievously by default. If India is to capture the export market in glassware, particularly in the neighbouring countries, the question of freight and transport policy both by land and sea will have to be properly examined.

## THE QUALITY OF PRODUCTION.

29. With a view to assessing correctly the quality and performance of the Indian made glass articles as compared with those of the imported glassware, one of the members of the Panel, Dr. Atma Ram had previously issued a questionnaire to elicit the opinion of big consumers such as chemical and pharmaceutical manufacturers, excise departments, brewers, medical institutions, railways, public works and health departments of the Governments, engineering firms, purchase and inspection authorities including testing departments of the Government and importers of glassware, etc., in the different Provinces and States. The replies received would be of considerable interest, particularly for planning the future of the industry. It is known that so far no arrangements have been made in India by any Government agency or producers for the regular testing and standardisation of the various types of glassware. Some of the common defects pointed out by the consumers are non-uniformity of shape and volume, varying wall thickness, lack of proper finish, comparatively poor annealing resulting in undue breakage in transport and storage, low thermal endurance and lack of brilliance. It has also been stated that there are some special defects as well, e.g., Winchester bottles made in India for the storage of acids are considered to be unsuitable due to the incorporation of arsenious oxide in the glass batch. Some of the defects are no doubt due to purely war-time exigencies such as shortage of proper chemicals, refractories and fuel, but other defects are also due to lack of proper technical control. In an industry in which mechanisation has progressed so little as yet and labourers are often moving away to other jobs attracted by higher wages, non-uniformity in production, as well as in the accuracy of capacity and dimensions has been accentuated.

30. Nevertheless, the burden of evidence collected from manufacturers, dealers, etc., has been that an organised effort is necessary on the part of Indian producers if Indian products are to compete successfully with imported glassware. Some of defects are both avoidable and unavoidable. During the War, the emphasis has been on quantity rather than on quality and the Indian products

have captured the home market only because imported articles have not been available at all., The replies as a whole do not indicate any particular prejudice against Indian made articles, provided comparable quality and performance can be ensured., The prejudice, if at all, is due to the lack of uniformity in production and in quality of the articles produced. That is to say, it is a case of preferential consideration of quality of articles rather than an express prejudice against Indian made goods as such.\* There are certain classes of articles however, such as bottles, particularly those required to stand pressures (mineral water bottles, excise bottles etc.,) scientific glassware of quality and precision and fancy glass articles which will continue to be imported unless the quality and performance of the Indian products can be improved to a standard comparable with that of the imported articles.

### CONDITION OF GLASS FURNACES IN INDIA.

31. High temperature furnaces constitute a most important equipment of glass factories. Within the last few years there has been a growing tendency among glass factories to change over from pot furnaces to tank furnaces., This has been due to a realisation of the limitations and wastefulness of the Japanese pot furnaces and the advantages of adopting the improved technique obtaining in other countries. A reduction in fuel cost was considered particularly important in a comparatively depressed market such as obtained during the years preceding the war. The trend towards changing over to tank furnaces received further impetus immediately after the outbreak of the War with Japan when it became difficult to get pots from that country. Many of the tank furnaces, however, are direct-fired and so suffer from practically all the defects of the older pot furnaces except that the pot has been eliminated and some slight economy of fuel effected. A number of regenerative and recuperative furnaces have been built in some factories but in regenerative furnaces of indigenous designs, some of the units suffer from a great many drawbacks, e.g., use of small refractory blocks in building the basin of the tank furnaces, use of fire bricks instead of silica bricks in building furnace crowns, ineffective heat insulation, and so on. Similarly, in one or two cases, the annealing lehrs were so badly built that they gave results worse than those obtained with ordinary annealing chambers. The following statement clearly shows the unsatisfactory position with regard to furnaces.

#### *Furnaces.*

Total number of glass factories .. ..	174
Factories having regenerative or recuperative furnaces .. ..	24 (13.8%)
Factories out of the above 24 which have efficient and well designed furnaces .. ..	10 (5.7%)

#### *Annealing Lehrs.*

Number of factories making hollow-ware .. ..	125
Direct-fired pan lehrs .. ..	10 (8.0%)
Gas fired or oil fired lehrs with automatic conveyers .. ..	5 (4%)

The use of incorrect type of fuel has also in some cases resulted in bad performance of otherwise good units. Further, better furnaces require trained personnel to keep them in good running order and in this respect, too, difficulty has been experienced. Some attempts have been made in the past to build with Government aid demonstrational furnaces of improved types in a few factories in U.P. A few other factories in Bengal acting on their own initiative have installed "Teisen" recuperative furnaces. In some other cases still, good

regenerative units have been built by the factories through their own efforts. Thus, it would be seen that the progress achieved so far is very meagre and it is only by organised and intensive efforts coupled with proper supply of raw materials and transport facilities that the position can be improved satisfactorily. Recently some efforts have been made with considerable success to use fuel oil in place of steam coal. Fuel oil gives better control of temperature and is also more economical in terms of cost of labour, storage room and furnace. The use of fuel oil should be encouraged not only because it is a by-product in the manufacture of petrol but also in the interest of conservation of high grade coal. The price of furnace oil should be so regulated that the price of crude oil is not higher than double the price of coal, ton for ton.

#### CAUSES OF THE BACKWARD STATE OF THE INDUSTRY.

32. The Panel has already referred to the factors which have contributed to the backwardness of the glass industry in India as against the glass industry in some other countries. In other countries with a flourishing glass industry, there has been an organised effort to incorporate scientific and technical improvements in the glass industry and secondly, the State itself has come forward to foster and encourage the industry by suitable measures. In India, on the other hand, the manufacturers have not been able to take advantage of the technical developments which have been made in other countries and the State has also not realised adequately its responsibilities towards the development of this important industry. Broadly speaking the causes of the backward state of the glass industry in India may be summarised as follows:

- (i) Uneconomic conditions created by dumping and unfair competition by well-established foreign industries and the failure of the State to extend tariff protection on an adequate scale to the struggling Indian industries.
  - (ii) Lack of proper and sound internal organisation of the industry which has grown up partly on a cottage and partly on a large scale basis.
  - (iii) Low technical standards and slow progress in technical developments both as a result of severe competition from abroad and due to the absence of technological institutions.
  - (iv) Want of proper supply of raw materials, fuel, refractories and transport facilities.
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## PART II.

## THE GLASS INDUSTRY AS A KEY INDUSTRY.

33. As a result of intensive application of scientific methods to industrial production, glass which was once only an article of artistic taste, has emerged as a material of wide utility and strategic importance, which can be processed in a variety of ways to meet the increasing requirements of both war and peace. It is marvellous to contemplate that such a fragile material like glass could be made into such varying types of articles, ranging from fabric to blades and flanges of centrifugal pumps. Indeed, glass is to-day one of the triumvirate of modern industrial materials—the other two being steel and rubber—which are largely responsible for the progress of science and technology. Many scientific instruments and apparatuses of the most complex kind depend on the glass industry. Its optical characteristics, resistance to corrosive materials, non-combustibility and insulating properties, make it a versatile material in modern technology, while its cleanliness and transparency make it a very suitable material for household wares and now even for furniture and fabrics. Modern housing ideas, particularly with emphasis on sanitation, lean increasingly on the use of glass as building material, while chemical, pharmaceutical, fermentation and other industries have to depend for a wide variety of containers, essentially on glass. In the electrical industry also glass with its insulating properties plays an important role. Again, there is the industrial problem created by the progressive exhaustion of irreplaceable metal resources, particularly of key non-ferrous metals like copper, zinc, tin and lead. Here glass along with plastics, which are made from resources which can be classed as almost inexhaustible, may be expected to replace metals in a variety of uses, and thus help in the conservation of metallic resources. The production of toughened glass, a material possessing tensile strength, has further extended its field of utility. From all these considerations, the versatility of glass as a key material of wide application is easily established. In the optical industry particularly which is of such strategic importance in science and war, glass occupies a key position. Glass is now universally regarded as a key material. It is unfortunate therefore that whereas other countries have made such rapid progress in making glass a key industry, conditions in India have remained comparatively stagnant.

## POST-WAR TARGETS.

34. Seen from a wide perspective, the glass industry thus is bound to occupy in the long run, a very important place in our industrial structure. What is more relevant here, however, is to lay down roughly the scope and extent of development of the glass industry in the immediate future, that is to say, during the next five years. As already stated, the output of the glass industry in India has greatly increased during the war and in several lines the present productive capacity of the glass factories to-day is sufficient to meet the total requirements of the country at the existing level of consumption provided, of course, that the manufacturers are assured of adequate transport facilities and supplies of the necessary raw materials and coal and the glass manufacturers concentrate on improving the quality of production and undertake proper grading, standardisation and marketing of the products. The Panel thinks that if India is to occupy a place in the industrial world, the aim should be to reach at least the level attained by the glass industries in the other countries, in the course of the next ten years. This will undoubtedly call for a great deal of effort and organisation but it should not be difficult to attain this high level.



35. In laying down the targets, the Panel has proceeded on the following basis :—

- (i) In respect of articles which are now produced in this country but whose supplies have to be partly supplemented by import, our aim should be to raise the scale of output to such a level and attain such a quality that the total requirements of the home market can be met wholly by domestic production;
- (ii) In respect of articles which are not yet produced in this country, the aim should be to initiate their production without delay; and
- (iii) During the war emphasis has been more on quantity than on quality. In the coming years more stress should be laid on attaining a standard of quality which could compare reasonably with similar articles from foreign countries.

36. On this basis, the Panel gives the following statement of targets of production during the first five years for the different sections of the glass industry together with a note on the Panel's recommendations in respect of each of these sections :—

#### STATEMENT OF TARGETS FOR THE FIRST 5 YEARS

Section	Pre-war production 1937-38	Pre-war Import 1937-1938	Pre-war total consumption	Target	Present production capacity
1. Bangles ...	Rs. 80 lakhs (12,000 tons)	Rs. 29.3 lakhs (3,000 tons)	Rs. 109.3 lakhs (15,000 tons)	19,800 tons.	18,000 tons.
2. Beads & false pearls.	...	Rs. 18.9 lakhs (4,2000 tons)	4,200 tons.	4,200 tons.	120 tons.
3. Bottles & Phials (a) .	Rs. 10 lakhs (20,000 tons)	Rs. 29.3 lakhs (60,000 tons)	Rs. 39.3 lakhs (80,000 tons.)	100,000 tons.	100,000 tons
4. Lampware ...	Rs. 20 lakhs (7,500 tons)	Rs. 6.9 lakhs (2,000 tons)	Rs. 26.9 lakhs (9,500 tons)	14,000 tons.	10,000 tons
5. Tableware ...	Rs. 8 lakhs (2,500 tons)	Rs. 6.0 lakhs (2,500 tons)	Rs. 14 lakhs (5,000 tons)	7,500 tons.	5,000 tons.
6. Pressedware	Rs. 2 lakhs (1,000 tons)	Rs. 5.0 lakhs (1,500 tons)	Rs. 7 lakhs (2,500 tons)	4,000 tons.	2,000 tons.
7. Sheet Glass (b)	6 million sq. ft.	22 million sq. ft.	28 million sq. ft.	42 million sq. ft.	20 million sq. ft.
8. Plate & figured	...	3.4 million sq. ft.	3.4 million sq. ft.	4 million sq. ft.	...
9. Scientific glass apparatus (c)	Negligible	Rs. 1.9 lakhs	Rs. 1.9 lakhs	Rs. 10 lakhs *with proper quality	...
10. Glass shells ...	...	...	...	25 million pieces.	14 million pieces.
11. Optical glass (d)	...	...	...	...	...

Notes :—

- (a) Statistics of mineral water bottles and other bottles should be maintained separately.
  - (b) Statistics of pressed-ware as well as of sheet glass and plate should be maintained separately.
  - (c) Many of the scientific apparatuses made in India lack in precision. Therefore, the productive capacity is not set down.
  - (d) Statistics of optical glass could not be obtained ; hence the target could not be set.
- All figures given in tonnage and within brackets, are estimates.

(1) *Bangles.*

37. The Panel considers that the production of bangles has reached a stage when our domestic output is sufficient to meet the post-war requirements of the country. In respect of some varieties of bangles, however, which have so far been exclusively imported, there is scope for development and an increase of 10 per cent in tonnage or 1,800 tons may be set down as the target for the first five years.

(2) *Beads and pearls* (see below).(3) *Bottle-ware.*

38. The domestic production of bottles has increased several-fold to meet the increased war-time requirements and the Panel feels that the present productive capacity is sufficient to meet the entire requirements of our home market in the immediate future. But the quality of the bottles has to be improved very considerably if our products are to compete successfully with the imported articles.

(4) *Lamp-ware.*

39. During the war, on account of the switching over of lamp-ware producers to the production of bottles, the supply of lamp-ware diminished greatly but as this was accompanied by a shortage of kerosene, the pressure of effective demand was relieved to that extent. With the return of normal conditions, the use of kerosene lamps in the rural areas is likely to increase very considerably in spite of the spread of electrification. The target accordingly has been set at 14,000 tons as against the present production capacity of 10,000 tons per annum.

(5) and (6) *Table-ware and pressed-ware.*

40. During the war, there has been an acute scarcity of table-ware of all classes. The Panel anticipates a large increase in the demand for table-ware and pressed-ware in the immediate post-war period. This is because the use of glass table-ware has spread even to the rural areas. Particularly in view of the high price of metal articles which is likely to continue for some time, on account of competing demands for metal, the demand for glassware is likely to increase even further. The Panel, therefore, recommends that the target for the increase of production of table-ware should be set at nearly 50 percent over the tonnage of total consumption in pre-war years.

(7) *Sheet glass.*

41. As already stated, the total quantity of sheet glass produced by the three Indian factories, is about 13 million sq. ft. whereas their full production capacity is rated at about 20 million sq. ft. per annum. This capacity is being raised to 30 million sq. ft. soon. The Panel has set the post-war target during the first five-year period at 42 million sq. ft. on the assumption that we shall be able to meet the whole of the increased requirements of the home market without recourse to importation.

(8) *Plate glass* (see below).(9) *Scientific glassware and apparatus.*

42. As already stated, the scientific glassware industry started during the war, has been able to meet a considerable part of the country's requirements mainly due to stoppage of imports. As more and more of scientific and educational institutions would be established in the post-war period, the Panel anticipates that the present demand would increase several-fold. The Panel, has therefore, set the target at Rs. 10 lakhs. But in view of the exacting require-

ments of this type of glassware, the quality and precision of the articles produced need considerable improvement and should be brought up to the level of imported articles. The maintenance of the uniformity of production is a *sine qua non* for this development; this again would be possible only if adequate supply of raw materials and chemicals of proper standards can be ensured.

(11) *Optical glass* (see below).

#### ESTABLISHMENT OF NEW INDUSTRIES.

(a) *Beads and false pearls.*

43. The consumption of beads and false pearls amounted to Rs. 18.5 lakhs in this country before the war and the whole of this was imported mainly, from Czechoslovakia and Japan. Due to the exigencies of the war, this import was completely stopped. Although bead making on a cottage scale has recently been started in India mainly by students trained at the Glass Technology Section of the U.P. Government, the output is yet too small to meet the country's requirements. The Panel recommends that this line of production should be taken up on an organised basis. The Panel is not in possession of the details of the different processes of manufacture in use in other countries, particularly in Japan, Czechoslovakia and Italy. But in order that the industry should be started and established as soon as possible, the Panel suggests that:—

- (i) two batches of at least three technical men (one scientific worker and two practical workers already acquainted with the nature of the work) should be sent to Japan and Czechoslovakia respectively to study the various processes of bead making; and
- (ii) arrangements should be made to bring a few Japanese and Czech bead makers to India, with those people on their return.

The Panel considers that such a procedure would be a more practical way than merely importing foreign experts to train the local workmen in this country. This will enable our technical men to see what is actually being done in these countries. Meanwhile, arrangements, both financial and organisational, for starting bead works should be completed, so that when these people return, they can find adequate scope for utilising their technical knowledge and experience effectively.

(b) *Plate glass and optical glass:*

44. These new lines should also be taken up during the first five-year period. The processes of manufacture of these articles are very exacting and complicated, and their manufacture also requires a large outlay of capital. The processes are covered under patents or under trade secrets and long established and standardised techniques of a few concerns. Optical glass manufacture also involves extreme precision of work. The total demand of optical glass is not at present very large in India but optical glass is an indispensable and strategic material and, weight for weight, optical glass is the highest priced of all glassware. The smallness of Indian requirements of optical glass has often been cited as an argument against starting the industry in India in the immediate future. The Panel completely rejects this view because the optical glass industry is a vital and key industry both in peace and war. The Panel strongly recommends the starting of this strategic industry without delay.

#### EXAMPLE OF CANADA.

45. The Panel is convinced that the normal method of laboratory experiments followed by commercial exploitation would not be a quick and practical way of establishing the optical glass industry whose production has reached

a high state of perfection and standardisation in other countries. In this context, it would be useful to cite the example of Canada. Canada did not have any optical glass industry before the war. But the Canadian Government decided to take immediate steps for the speedy production of optical glass. The co-operation of certain British firms was enlisted through the British Government. In this connection the following account given by Dr. W. M. Hampton, Physicist of Messrs. Chance Brothers & Co., Ltd., describing how the industry was established in Canada, is worthy of note:—

“A Government Company, Research Enterprises, Limited, was formed during 1940 to erect a factory in Toronto for the manufacture of various instruments, and in some cases the raw materials which were necessary for them. When it was decided, about October, 1940, to commence the manufacture of optical glass there, Colonel W. E. Phillips, the President of the Company, approached Chance Brothers & Co., Ltd., through the Canadian and British Governments, with the suggestion of co-operation. As a result of that approach, I visited Toronto in November, 1940, in order to ensure the most rapid development of the new undertaking. The result was that an arrangement was reached whereby the fullest information concerning the manufacturing technique was transferred to the Canadian factory, and certain physicists from Canada came to England and were trained in the art and technique of making optical glass. These physicists remained at our works for some two to three months and were attached to our own personnel, so that they had the fullest opportunity of learning all that we could teach them about the manufacture of optical glass. A number of other people were recruited in this country, some from the Canadian Forces here and some from our own staff, and were given a special intensive course before being sent to Canada for starting up the new process. Further, when manufacture began, one of our technicians went to Canada for some months in order to assist in overcoming the initial difficulties, so that the closest co-operation was maintained. When it is realised that in November, 1940, the optical glass plant consisted of merely the walls of what was to be a factory, and that the first melting was successfully made in June, 1941, and that by the end of 1941 a considerable number of meltings of first quality glass had been made, it will be realised that, owing very largely to the enthusiasm and drive of the Canadian executives, a very remarkable result has been achieved. There has throughout been the closest co-operation between the Canadians and ourselves and it can be said that there has been no serious hold-up or difficulty in transferring the manufacture from this country to that.”

In a similar manner, Australia too has developed an optical glass industry within the short space of a few years during the war.

46. The above examples would clearly indicate what could be achieved in India also if the co-operation of foreign firms which are already established in the line, could be enlisted. The Panel recommends that the Government should immediately explore the possibility of establishing the manufacture of optical glass and optical instruments in India on the Canadian model and establish a company with the Government contributing half the capital. In view of the comparatively greater risks and speciality of manufacture in this line, it is doubtful if any commercial concern would be willing to come forward without Government participation and foreign co-operation on some such lines. It may be of interest to mention here that the existence of a number of good workers trained in the operation of grinding of optical glass pieces at the Mathematical Instruments Office, Calcutta, which maintains a good precision workshop, would be of considerable help in starting the industry in our country and the nucleus of the M.I.O. as well as the Central Glass and Ceramic Research Institute could be usefully utilised in this connection.

47. The Panel further recommends the adoption of similar means also in the establishment of the plate glass industry (including the manufacture of toughened or armour plate glass which is important for defence purposes) in case private parties are not willing to come forward.

#### TECHNICAL TRAINING.

48. The paucity of adequately trained technical personnel in the glass industry has long been recognised as one of the reasons why the glass industry has particularly lagged behind in technical progress. The first notable effort to fill up the lacuna was the establishment of the Paisa Fund Glass Training Centre at Talegaon in 1908. In 1937, the Benares Hindu University took the initiative and provided certain facilities for training in glass technology. Although, the standards were not fully comparable to those attained in foreign countries, these facilities were greatly appreciated. Its graduates are finding employment in factories on an increasing scale and some of them are now holding responsible positions. In order that this Institution may more adequately meet the increasing and exacting demands of the glass industry, the Panel recommends that the University should review the working of the Department, which may also provide a better co-ordination with the industry. Further, more ample funds, to which the Government should also contribute, should be made available to the Institution, so that the facilities afforded by it may be further widened in scope as an integral part of the provision of technical training in this country. The Central Glass and Ceramic Research Institute (vide para. 51) should, of course, be also suitably provided with sufficient funds to perform its important role in the development of the Indian Glass industry, by organising research as well as providing facilities for higher technical training.

#### FOREIGN TRAINING.

49. The well-established and standardised processes in the manufacture of many types of glass articles such as optical glass, chemical resistant glass, toughened glass, plate glass, etc., are comparatively unknown in India. It would be essential not only to bring foreign experts on a contractual basis to train our workers in India but also to send suitable Indian personnel for training abroad. Only those who already possess some practical experience and theoretical training in the particular branch of the industry, should be sent abroad for further training. The Government have recently sent a number of students for training in glass technology. This has been done without proper liaison with the industry with the result that the latter has been unable to make full use of their technical knowledge after their return. Again, glass technology is a very wide subject and when sending students abroad, it would be necessary to specify the particular branch in which training is sought. To expect one person to return as an all-round expert in glass technology would be an error. Further, arrangements should be made for giving the students some basic training in the particular subject, before they are sent abroad.

#### TRAINING OF OPERATIVES.

50. In order that the operatives in the glass industry may receive better training and may also know the practical methods adopted in foreign countries in the actual process of production, the Panel recommends that some foreign operatives should be brought over to this country. As a first and experimental measure, the Panel recommends that operatives of the following four types should be brought:—

- (1) A foreman for operating semi-automatic machinery in the Blowing Department;
- (2) an engineer working for maintenance and repair of semi-automatic machinery in the Blowing Department and also experienced in its repairs;
- (3) a smelter for tank furnaces; and
- (4) a foreman of the pressed-ware department.

These men should also be attached to the Central Glass and Ceramic Research Institute which is being started. A supervisory Committee consisting of a representative of the Institute and two technical men from the industry nominated by the all-India Glass Manufacturers' Federation should be appointed. They should be brought on a contractual basis, say, for a period of three years in the first instance and they should be selected by representatives of the Glass Manufacturers' Federation and the Central Glass and Ceramic Research Institute. These people should be brought over as operatives or technical personnel and should in no case be put in executive or administrative posts.

### TECHNICAL INSTITUTIONS.

51. The Panel records its great satisfaction that the Council of Scientific and Industrial Research is establishing a Central Glass and Ceramic Research Institute at Calcutta for helping the development of the glass and ceramic industries in India. The establishment of this Institute is well under way and at this stage, the Panel does not think that it is in a position to say anything about the research grants and such other contributions. The functions which have been assigned to the Institute are of a very fundamental nature and the Panel only hopes that the Government would ensure that the Institute is suitably provided with ample funds, equipments and staff to discharge its important functions properly.

52. The Panel has also deliberated as to how the Provincial organisations dealing with glass should be related to the Central Institute without risk of unnecessary duplication of work and functions. The Panel recommends that the Provincial Departments should be affiliated to the Central Research Institute in the general policy and working though they remain autonomous in their own activities.

53. *Bangle industry*.—The Panel would also like to refer to the question of a specialised school and a laboratory for the bangle industry which is predominantly located at Firozabad. The bangle industry has technical problems peculiar to its own (including particularly automatic stone-cutting and polishing, etc.), and also constitutes, judged by value of output, about 70 per cent of the entire glass industry. The Panel is of opinion that it is important that a specialised State school like that at Haida, Steinschonau, Zelenzny Brod, Gablonz or Turnov in Czechoslovakia be started at Firozabad with well experienced teachers trained over there and some experts brought over from there. It will be interesting to note that in Gablonz alone there were about 60 to 80 thousand glass workers employed as home workers in 1927 for Gablonz type of glass which includes fine varieties of bangles, beads, imitation precious stones, necklaces, watch chains and Bejoutrie. It would thus be seen that Firozabad is as important in India as Gablonz was in Czechoslovakia in 1927. The industry has considerably developed over there since but Firozabad has received very scanty help, if at all, from Government. The Panel considers that Firozabad is the proper place for the location of a laboratory for the glass industry. Although a laboratory has been located at Cawnpore for some time.

little useful purpose: is being served there by it, and the Panel considers that in the best interests of the glass industry, the laboratory should be transferred to Firozabad. This view, however, is not endorsed by Dr. A. Nadel, who, unfortunately, could not attend the final meeting of the Panel in which this question was fully discussed.

#### CO-OPERATION WITH FOREIGN FIRMS.

54. In the recommendations relating to the development of the optical glass industry, the Panel has indicated a model of foreign technical co-operation which it would welcome in India also in the interest of the speedy development of the industry. There is at present practically, no foreign capital in the Indian glass industry and the Panel does not think that the industry has any need for foreign capital; all that is required is technical knowledge, technical personnel and facilities for training of Indian technicians on an adequate scale. The Panel does not think that it is possible to have the technicians trained in a particular art of manufacture without interesting the foreign firms in some form or the other. There can be several methods of doing this, e.g., by taking a certain process under licence and agreeing to make payments over a certain period, or by allowing a stipulated share in the profits. The Panel is of the opinion that the question of co-operation with foreign firms should be faced on a realistic basis and decided strictly in consonance with our wider national interests. The Panel, however, emphasises that the co-operation should not be made in such a manner and to such an extent that the Indian industry is converted into an appendage of foreign interests. The direction and control of policy should and must always remain in the final analysis in Indian hands and even when foreign experts have to be appointed, the key executive positions must be manned by Indian alone.

#### GOVERNMENT OWNERSHIP.

55. The Panel has given careful consideration to the question in the General Directive as to the extent to which the industry should be under Government ownership either on wider grounds of national interest or because private capital is unlikely to take it up. The Panel is of the opinion, on the basis of the evidences collected by it, that the glass industry should not be owned by the Government except to the extent and in the manner already indicated in the Panel's discussion on the establishment of the optical glass and plate glass industries. In the case of the optical glass industry, which is of vital importance in our economy not only from strictly industrial considerations but also from the point of view of the essential defence requirements of the country, its partial ownership by the Government would be justifiable. The more so, because private enterprise in this particular line is unlikely to come forward at this stage. Apart from this particular instance, however, the Panel does not think that there is any case for Government ownership in other sections of the glass industry.

#### LOCATION OF THE INDUSTRY.

56. During recent years, the problem of localisation of industry has attracted considerable attention. Broadly speaking, the three important locational factors are, availability of raw materials, nearness to the market and the availability of skilled labour in the particular area. In the case of the glass industry, the factor of nearness to the market is probably of greater determining influence than the nearness to raw materials. This is mainly due to the fragile nature of glass articles which does not bear so easily haulage over long distances. Moreover, glass articles

in the finished form are, weight for weight, much more voluminous than the raw materials, and have to pay much higher rates of railway freight than the raw materials. The success of many industries in the south and north-west of India far removed from the sources of raw materials and fuel is to be attributed to the importance of nearness to market as a locational factor.

57. During the war, when the essential aim has been to supply the increased requirements of the country at any cost, due regard could not always be given to the more permanent and stable locational factors of the industry. During enquiry, the Panel has noticed a tendency, natural enough, on the part of every Province and State to have every section of the industry located within its respective jurisdiction. Without making any specific reference, the Panel may add that in some cases this desire was not altogether well-founded. While the Panel is fully alive to the need of balanced and co-ordinated development of the resources of all the Provinces, it is strongly in favour of the formulation of a rational localisation policy which does not sacrifice the most economic production and efficient utilisation of our resources and transport facilities. While we must eschew narrow provincial feelings, at the same time, no Province should be allowed to have a virtual monopoly of any particular industry unless natural factors absolutely dictate such a dispensation. The State should exercise some control through a proper machinery on the establishment of factories by introducing some kind of licensing system, so that a rational localisation policy may be enforced. The need for such an intervention is exemplified by the case of the sugar industry. After the grant of protection to the industry, a large number of factories were established in the U.P., concentrated in a small area. Consequently, there ensued an unhealthy competition over the sugar-cane grown in the locality, throwing at the same time a great burden on the railways for handling cane for long distances. The situation became so serious that the U.P. Government had to intervene and introduce a zonal system. Another direction in which control may be of help would be to avoid the growth of a large number of factories specialising in the production of goods of only one type while there may be enough field for the manufacture of articles in other lines not yet adequately developed. This should not, however, imply grant of monopoly to some particular factory.

58. In the N.-W.F.P., and in Southern India, the glass industry is comparatively less developed. Manufacture of lamp-ware, table-ware, pressed-ware and sheet glass may very well be developed in these regions. In the N.-W.F.P. fuel oil is available near at hand, while other raw materials are suitably available in both the zones. Efforts should also be made to investigate the possibilities of the glass industry in Rajputana and Central India which may possess some advantages in regard to the glass industry. The Panel may also refer here to the case of the manufacture of sheet glass. The present factories are located in the northern belt. But in view of the demand from the southern regions, the Panel feels that at least one factory must be opened somewhere in the southern regions. Although the cost of production of sheet glass may be comparatively lower in the three existing factories located in the northern regions, the burden of increased freight on sheet glass to the southern markets may neutralise the additional cost of manufacture of sheet glass in Southern India, where, moreover, a sheet glass factory will have good prospects for exporting to the neighbouring overseas countries. The Panel cites this case of sheet glass only as an illustration of the considerations which must be taken in determining the localisation policy for the industry.



## RAILWAY FREIGHT.

59. While on the subject, the Panel would also like to raise the question of revision of railway freight on glassware in relation to the national localisation policy. The freight charged on glassware on different railway lines is very disparate. The E.I.R. is charging railway freight equal to first class rates. Some railways charge second class rates, some fourth and some even higher rates. These rates have to be rationalised and brought in line with a national localisation policy. The Panel, therefore, recommends that the railway freight on glassware should be rationalised on an all-India basis and made more homogeneous than at present and fixed at not higher than first class rates. However, since this is concerned more with the general railway rates policy, the Panel leaves the question of details to the appropriate authorities,

## CASE FOR PROTECTION.

60. The case for protection of the glass industry was very ably presented by the Tariff Board set up in 1931. The Panel has gone through all relevant data in this connection. The glass industry is not only one of the major consumer goods industries, but is one of the vital key industries. The annual production of the industry at pre-war price level averaged Rs. 1.5 crores before the war and it has increased very much during the war. The Panel is again duly impressed by a remarkable fact. Whenever the industry has been freed from the pressure of unfair foreign competition, as during the two Great Wars, it has made striking headway, but with the cessation of hostilities, competition of powerful and established industries abroad has tended to smother further development. Already the glass manufacturers are obsessed with the possibility of the repetition of the experience after Great War I. The Panel feels that in order to preserve the industry and foster its further development, the Government should guard it against foreign competition by granting tariff protection for a period within which the industry should develop itself sufficiently so as to be able to stand in the open market even after the withdrawal of protection. Several advanced countries like U.S.A., France, Belgium, Germany, Czechoslovakia, etc., have done this before and the Government of India should at least now realise the importance of the glass industry in our national economy. After examining all relevant data, the Panel is convinced that without the grant of protection, the industry which has expanded considerably during the war, will be unable to withstand foreign competition in the post-war period. The Panel, therefore, strongly recommends that the case of the glass industry should be referred to the Tariff Board for enquiry into the details of the kind and extent of protection for the different types of articles which has to be extended to the industry.

## TRADE MARKS AND STANDARDISATION.

61. If the industry is granted protection, which entails the placing of some burden on the consumers, the Panel considers it necessary for the Government to ensure that the industry develops along proper lines so that, within the stipulated period of time, it may organise itself by improving the quality and performance of its products to a level comparable with those of foreign countries. The Panel feels that although it is very difficult to lay down a rigid test, it would be essential to ensure that some kind of check or control is exercised on the proper planning of the industry and the quality of articles produced. The Panel considers that a system of trade marks for the individual factories and the checking up on the quality of products by occasional standardisation by the Central Institute may be of some help in this direction. The Panel however is not immediately in a

position to lay down clearly the details of this control. The Panel recommends the standardisation and laying down of specifications both for raw materials and finished goods. In the absence of such standardisation, the Indian manufacturers cannot be assured of the quality and uniformity of raw materials without which the quality and uniformity of products cannot be maintained. From the evidence the Panel has collected, it is inferred that lack of uniformity of production is one of the chief complaints against Indian made articles. The Central Glass & Ceramic Research Institute, should from time to time lay down specifications for the glass industry and should help in the testing and standardisation of finished products.

### SURVEY OF RAW MATERIALS.

62. It is now generally agreed that a proper survey of raw materials is one of the best forms of assistance that can be rendered to an industry especially in a country which is on the eve of large-scale and many-sided development. Unless the raw materials required for this industry are properly surveyed and their occurrences, properties and suitability for specialised purposes are properly charted and assessed, it is difficult to see how an industry can be developed and how its regionalisation can be properly planned. At present whatever information is available is mainly through the records of the Geological Survey of India. Efforts by other agencies have been fragmentary and quite incommensurate with the requirements of large scale development of the industry throughout the country. It is understood that the Council of Scientific and Industrial Research is aware of the importance of this consideration and is contemplating to take some concrete steps in this regard. The Panel is convinced that without a proper survey of raw materials, proper and co-ordinated development of the industry will be very difficult. It, therefore, strongly recommends that the Government should undertake immediately an organised and comprehensive survey of raw materials either under the direction of the Geological Survey or under the Council or under a system of co-operation by both the bodies. The examination of the properties of the samples should be done by one organisation, preferably by the Central Glass & Ceramic Research Institute. The Industrial Research Bureau organised a survey of glass raw materials and quite a large number of samples were analysed. The results of the analysis of samples of sand are reproduced in the Appendix in Statements No. 5 & 6, by the courtesy of the Council of Scientific & Industrial Research.

### STATISTICS AND INFORMATION.

63. In its enquiry the Panel has been very much handicapped by the absence of reliable and properly organised data regarding the industry. Even the statistics of total production of glassware in India has never been collected in a proper manner. Again, for example, separate figures for the import of plate and sheet glass, are not shown. At this stage of industrial development, it is impossible to over-emphasise the need for collecting data, properly classified and organised for purposes of enquiries and planning. The Panel suggests that the All-India Glass Manufacturers' Federation which represents the majority of the glass manufacturers in the country, should assist the Central Institute in its task of collection of data. One of the handicaps under which the industry has worked is the lack of information regarding many aspects of glass manufacture. The majority of the factories are not in a position to maintain a well-organised library. The Central Glass & Ceramic Research Institute should, therefore, help in the dissemination of information by (a) bulletins on technical subjects in simple

language and (b) reviews on important topics connected with the industry. Further, in order that the Glass manufacturers may have the opportunity of seeing the developments in other countries through the help of models, charts and other exhibits and may also know the position of their own industry vis-a-vis that in other countries, the Panel strongly recommends the establishment of a central museum at the Central Research Institute, where raw materials, finished goods, models of machineries, furnaces, etc., used in this country and abroad as well as charts of production would be displayed.

### INDUSTRIAL ASSOCIATIONS.

64. The intense pressure of foreign competition tended to develop a sense of extreme individualism and mutual suspicion among the glass manufacturers in India. The Panel considers that the establishment of representative industrial associations is very essential for the healthy growth of the industry. It is however, opposed to the formation of cartels which ultimately results in crude monopolistic trends. However, the establishment of a central organisation representing the manufacturers is very essential and will also be helpful to the Government in assessing the requirements of the industry from time to time on a collective basis. There are at present 4 zonal associations viz., the Northern India Glass Manufacturers' Association, the U.P. Glass Manufacturers' Syndicate, the Bengal Glass Manufacturers' Association and the South Indian Glass Manufacturers' Association, in addition to the Glass Industrial Syndicate representing bangle manufacturers of Firozabad. There is a central organisation known as the All-India Glass Manufacturers' Federation, which is in the main, a federated body of the four zonal associations. It is understood that the bangle manufacturers' organisation is also joining the Federation. Thus it would appear that the majority of the glass manufacturers have already come under this central organisation. This is a very healthy sign for the industry and will no doubt contribute to its development and stabilisation on a sound basis. The Panel thinks that it will be helpful both to the Government and the industry if the former grant recognition to this central organisation in matters concerning formulation of policy which affect the interests of the industry. The Panel, however, would like to say frankly that this recognition should be accorded only by virtue of the services that the organisation performs not only to its individual members but to the country as a whole and not by way of putting powers into the hands of this central organisation.

### COTTAGE INDUSTRY.

65. As the Panel has already pointed out, the Indian glass industry is organised partly on the basis of cottage industry and partly on the basis of large-scale industry. Some important sections of the glass industry such as bangle making, table blowing, bead making and the manufacture of looking glasses and small phials are already working on a cottage industry basis. It appears to the Panel that there is a considerable sector in the industry in which organisation on the basis of small scale production can be profitably developed. At the same time the Panel points out that the process of mechanisation in the large-scale sector of the industry has been much lagging behind compared with that in other countries. The indigenous manufacturers, apart from a few exceptions, have so far paid little attention to the improvement of the efficiency of the glass furnaces and annealing lehrs. There is also urgent need for the import of semi-automatic blowing machines for the glass factories in general. The Panel considers that the Government should give every facility for the early importation of machinery.

## CONCLUDING REMARKS.

66. In making its recommendations, apart from the specific points mentioned in the General Directive and the question of attaining the targets for the first five years, the Panel has attempted to take a long range and detached view of the glass industry as a whole. The Panel has presented the causes of the backwardness of the glass industry in India in contrast to the rapid progress which has been achieved in other countries. The position of the glass industry at present in India is very similar to its position at the end of Great War I in other advanced countries. The Panel has recommended measures which it thinks would help the early removal of the causes of this backwardness. In particular the Panel feels that unless steps are forthwith taken to remove the apprehensions of the industry against the reappearance of foreign competition in an accentuated form, as happened after Great War I, it will be very difficult to establish the confidence of the industry in the efficacy of any measures, however well-intentioned, which the Government may contemplate in the interest of the industry. The Panel has also taken into consideration the necessity of developing the resources of the country in a co-ordinated and balanced manner so that different regions may share duly in the progress of the country and of the industry as a whole. The Panel feels, again, that the progress of the glass industry will depend not only on what the Government does for it but also and especially on what the industry itself is willing and able to do for itself.

67. The Panel also feels that the recommendations that it has made above are of such a character that for some years to come occasional consultations will be necessary. For this purpose the Panel suggests that a small consultative committee consisting of the Chairman of the Panel, a representative of the Central Glass & Ceramic Research Institute, a representative each from the four zonal associations (viz., the Northern India Glass Manufacturers' Association, the U.P. Glass Manufacturers' Syndicate, the Bengal Glass Manufacturers' Association and the South Indian Glass Manufacturers' Association) together with a representative of the all-India Glass Manufacturers' Federation, with power to co-opt specialists, should be constituted after the work of the Panel is over.

## SUMMARY OF RECOMMENDATIONS.

The Panel recommends that in the course of the next 10 years, India should aim to reach at least the level which has already been attained by the glass industries in other countries. (Para. 34).

In regard to the sections of the glass industry which have already been developed in India, our aim should be to raise the scale and quality of output to such a level as will enable the requirements of the home market to be met wholly by domestic production. In respect of other sections, production in these lines should be initiated without delay. (Para. 35).

*Targets for the first five-year period:—*

1. *Bangles.*—Pre-war production was 12,000 tons or Rs. 80 lakhs so that together with pre-war import of Rs. 29.3 lakhs (or 3,000 tons) pre-war consumption totalled Rs. 109.3 lakhs. Present production capacity is 18,000 tons. During the next five years, domestic output should be increased by 10% or 1,800 tons particularly by developing production of fancy bangles which have been hitherto almost wholly imported. (Para. 37).

2. *Bottles and phials.*—Pre-war consumption was Rs. 39.3 lakhs including Rs. 10 lakhs of domestic production and Rs. 29.3 lakhs of imports. Production capacity today is 100,000 tons as against the estimated pre-war capacity of probably about 20,000 tons. No further increase in production capacity is called for, because it is anticipated that an output of 100,000 tons would be enough to meet domestic requirements during the next five years, but quality has to be considerably improved. (Para. 38).

3. *Lampware.*—Pre-war consumption was 9,500 tons valued at Rs. 26.9 lakhs. This included Rs. 20 lakhs (or 7,500 tons) of domestic production and Rs. 6.9 lakhs (or 2,000 tons) of imports. Present production capacity is 10,000 tons. During the war, demand has been repressed only because of scarcity of kerosene. With the removal of this cause, demand may be expected to increase considerably and accordingly, the target has been set at 14,000 tons. (Para. 39).

4. *Tableware.*—Pre-war consumption was 5,000 tons valued at Rs. 14 lakhs of which as much as Rs. 6 lakhs (or 2,500 tons) were imported. During the war production capacity has been raised to 5,000 tons. This should be further stepped up to 7,500 tons. (Para. 40).

5. *Pressed-ware.*—Pre-war consumption was 2,500 tons or Rs. 7 lakhs, including Rs. 5 lakhs (1,500 tons) of import. During the war, production capacity was stepped up to 2,000 tons and this should be further raised to 4,000 tons in the course of the next 5 years. (Para. 40).

6. *Sheet glass.*—Before the war, India consumed 28 million square feet of sheet glass, of which hardly 6 million square feet were produced in the country. The three Indian factories together now produce 13 million square feet, although their rated capacity is 20 million square feet per annum. This is already being further increased to 30 million square feet soon. The target for the next 5 years is set at 42 million square feet, on the assumption that we shall be able to meet the whole of the increased requirements of the home market without recourse to importation. (Para. 41).

7. *Scientific glass apparatus.*—Before the war, we imported Rs. 1.9 lakhs worth of scientific glass apparatus, domestic production being negligible. During the war domestic production increased and was able to meet a considerable part of the country's requirements. With the establishment of more and more scientific and educational institutions, demand is found to increase several fold and the target for production has been put at Rs. 10 lakhs. Particular attention must be paid to maintaining quality and precision. (Para. 42).

8. *Beads and false pearls.*—Before the war, we imported 4,200 tons valued at Rs. 18.9 lakhs, domestic production being nil. Today, we produce a negligible quantity (120 tons). Proper technical training at home and abroad in this line should be arranged by the Government so that within five years, we may increase our domestic output to 4,200 tons and thus displace the whole of our pre-war import. (Para. 43).

9. *Plate glass.*—Before the war, we imported 3.4 million square feet of plate and flowered glass; the target for the first 5 years should be set at 4 million square feet. (Para. 44).

10. *Optical Glass.*—Figures of prewar consumption of optical glass could not be obtained and consequently, the panel is unable to fix a target. The figure was quite small. But the optical glass industry is a vital, strategic industry and must be started under Government auspices. (Para. 44).

#### *Technical training.*

Facilities afforded by existing technical institutes should be further widened in scope as an integral part of the provision of technical training in this country. (Para. 48).

#### *Technical Institutions.*

The Central Glass & Ceramic Research Institute at Calcutta which is being started should be suitably provided to discharge its important functions properly. Provincial departments should be affiliated to this Institute in the general policy and working but they should be autonomous in their own activities. The C.G. & C.R.I. should also pay attention to the question of training up suitable technical personnel. A specialised State school like that at Gablonz in Czechoslovakia should be started at Firozabad with experienced teachers trained over there and some experts brought over from there. The laboratory attached to the Glass Technology Section (Government of U.P.) should be transferred from Cawnpore to Firozabad. (Paras. 51-53).

#### *Foreign training.*

It would be essential not only to import foreign experts to train our workers in India but also to send suitable Indian personnel with previous training and experience for further training abroad in specific aspects of Glass Technology. This should be done with proper liaison with the industry so that the industry may make full use of their technical knowledge after their return. (Para. 49).

#### *Training of Operatives.*

As a first and experimental measure, the following four types of operatives should be brought to India from abroad:—

- (i) A foreman for operating semi-automatic machinery in the Blowing Department;
- (ii) An engineering worker for maintenance and repair of semi-automatic machinery in the Blowing Department and also experienced in its repairs;
- (iii) a smelter for tank furnaces; and
- (iv) a foreman of the pressed-ware department.

These men should also be attached to the Central Glass & Ceramic Research Institute and their work be supervised by a Supervisory Committee. They should in no cases be put in executive or administrative posts. (Para. 50).

### *Cooperation with foreign firms.*

In the interest of speedy development of new lines of the glass industry, e.g., optical glass and plate glass industry, the Canadian model of co-operation with foreign firms should be studied. In order to have the technicians trained in a particular art of manufacture, it will be necessary to interest the foreign firms in some form or other. The question of co-operation with foreign firms should be faced on a realistic basis and decided strictly in consonance with our wider national interests. The independence of our industry and final executive control by Indians must be maintained at all costs. (Paras. 45, 46 & 54).

### *Government ownership.*

The glass industry should not be owned by the Government except to the extent and in the manner indicated in the case of establishment of the optical glass and plate glass industries where private enterprise may not be forthcoming adequately at this stage. (Para. 55).

### *Localisation of the Industry.*

On account of the fragile and voluminous nature of the glassware, which does not easily bear haulage over long distances, nearness to the market is of greater determining influence as a locational factor than nearness to raw materials. Thus, it might be economical to start another sheet glass factory in southern India because, the higher cost of manufacture in the South may be counterbalanced by the saving in railway freight on finished products to the southern markets. Manufacture of lampware, tableware, pressedware and sheet glass should be developed in the N.-W.F.P. and Southern India where the glass industry is comparatively less developed now, but raw materials are easily available. A rational localisation policy has to be formulated and enforced through a licensing system so as not to sacrifice the most economic production and efficient utilisation of our resources and transport facilities. With this end in view, the 'zonal system' similar to that existing in the case of the sugar industry may have to be introduced. At the same time, railway freights for glassware will have to be rationalised and made more homogeneous. (Paras. 56-58).

### *Case for protection.*

The case for protection was very ably made by the Tariff Board set up in 1931 and should again be referred to the Tariff Board for enquiry into the details of the kind and extent of protection for the different types of articles which has to be extended to the industry. (Para. 59).

### *Trade marks and standardisation.*

If the industry is granted protection, the Government must ensure that the industry develops along proper lines so that after the stipulated period of time, it could compete with foreign industries in respect of quality and performances of its products. The Panel is not in a position to lay down clearly, the details of this control at this stage. But the institution of a system of trade marks for the individual factories and the standardisation of both raw materials and finished goods would be necessary. (Para 60).

### *Survey of raw materials.*

The Government should undertake immediately an organised and comprehensive survey of raw materials either under the direction of the Geological Survey of India or under the Council of Scientific and Industrial Research. The examination of the proper use of the samples should be done by one organisation. (Para. 61).

### *Statistics and information.*

Statistics regarding the industry should be collected and properly classified and organised for purposes of enquiries and planning. The All-India Glass Manufacturers' Federation should assist the Central Glass and Ceramic Research Institute in the task of collection of data. The Institute should help in the dissemination of information by means of bulletins and reviews and also by the establishment of a Central Museum. (Para. 62).

### *Industrial associations.*

While opposed to the formation of cartels, the Panel considers the establishment of representative industrial associations as very essential for the healthy growth of the industry. The Panel recommends that the Government should grant recognition to the All-India Glass Manufacturers' Federation which it should consult in matters concerning formulation of policy affecting the interests of the Industry. This would be, however, in recognition of the services which the organisation performs not only to its individual members but to the country as a whole and not by way of putting powers into the hands of the Central organisation. (Para. 63).

### *Cottage industry.*

There is a large scope for profitable development on the basis of small scale production in a considerable sector of the glass industry including, as for example, bangle making, table blowing, bead making, the manufacture of looking glasses and small phials, and so on. At the same time, there is an urgent need for greater mechanisation in the large-scale section of the industry. (Para. 64).

### *Consultative committee.*

The above recommendations are of such a character that for some years to come, occasional consultations will be necessary. Accordingly the Panel suggests that a small consultative Committee consisting of the chairman of the Panel, a representative of the Glass Manufacturers' Federation, a representative of the Central Glass and Ceramic Research Institute and a representative each from the four Zonal associations should be constituted after the work of the Panel is over. (Para. 66).

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## APPENDIX

## Statement No. 1

## NUMBER OF GLASS FACTORIES IN INDIA

PROVINCES	No. of factories		
	1939	1941	1944
Bengal	12	17	34
Bihar	1	2	8
Bombay	4	5	32
C.P.	3	4	6
Delhi	...	...	1
Madras	...	3	3
Punjab	1	5	6
Sind	3	...	1
Orissa	...	...	1
U.P.	49	79	70
<i>Total British India</i>	74	116	162
Hyderabad	2	2	2
Mysore	1	1	1
Other Indian States	3	4	9
GRAND TOTAL	80	123	174

**STATEMENT NO. Ia**  
**SHOWING THE PRODUCTION OF GLASS FACTORIES IN INDIA FOR**  
**THE YEAR 1945.**

Province					Production in tons for 1945.*	Number of factories included.
1. Bengal	...	...	...	...	55,200	29
2. Bihar	...	...	...	...	14,100	9
3. Bombay	...	...	...	...	20,700	15
4. C.P.	...	...	...	...	3,300	4
5. Delhi	...	...	...	...	2,100	1
6. Madras	...	...	...	...	11,400	4
7. Orissa	...	...	...	...	2,700	1
8. Punjab	...	...	...	...	6,600	5
9. U.P.	...	...	...	...	24,300	18
10. Sind	...	...	...	...	1,200	1
T O T A L ...					142,500	88
States					Production in tons for 1945	Number of factories included.
11. Bikaner	...	...	...	...	1,800	1
12. Dholpur	...	...	...	...	1,500	1
13. Faridkot	...	...	...	...	900	1
14. Gwalior	...	...	...	...	900	1
15. Hyderabad	...	...	...	...	3,300	1
16. Jaipur	...	...	...	...	900	1
17. Kotah	...	...	...	...	1,500	1
18. Mysore	...	...	...	...	450	1
T O T A L					10,950	8
G R A N D   T O T A L					153,450	96

\*The production figures have been calculated on the basis of returns which have been received in reply to questionnaires issued by the Panel. The returns, it is believed, in many cases indicated the production capacity, rather than actual production in the year.

Statement No. 2

VALUE OF GLASSWARE (MANUFACTURED IN INDIA) EXPORTED FROM INDIA  
(Thousands of Rupees).

	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41
Aden & Dependencies	3.3	3.3	4.0	5.1	2.7	1.8	2.4	5.1	5.0	1.8	4.6	13.5
Bahrain Islands ...	2.1	1.1	1.7	1.5	6.8	1.5	1.0	8.0	16.6	12.2	7.8	8.4
Ceylon (excluding Maldives ...	15.4	10.4	6.2	14.5	6.3	9.0	7.3	8.3	16.2	9.7	15.6	87.4
Burma ...	...	...	...	...	...	...	...	...	54.1	57.3	85.3	195.0
Federated Malay States...	5.3	4.4	1.7	1.5	.7	3.6	2.0	.5	7.5	6.8	3.8	5.2
Other British possessions. ...	29.3	28.2	21.9	8.5	9.0	11.1	6.7	7.0	11.0	8.4	20.4	78.3
Native States in Arabia ...	8.3	3.1	2.7	2.2	3.4	2.3	2.3	14.9	4.6	5.3	12.5	20.1
Iran ...	2.4	3.9	1.5	1.3	.4	4.6	3.5	2.1	6.9	7.6	7.0	16.1
Other foreign countries	16.3	6.7	6.5	8.0	16.7	7.9	4.5	3.3	7.7	6.1	12.6	159.8
<b>TOTAL ...</b>	<b>103.5</b>	<b>61.2</b>	<b>46.0</b>	<b>44.7</b>	<b>45.9</b>	<b>42.9</b>	<b>29.6</b>	<b>49.2</b>	<b>129.6</b>	<b>115.2</b>	<b>169.0</b>	<b>583.8</b>

Statement No. 3

VALUE AND QUANTITY OF GLASSWARE IMPORTED INTO INDIA  
(In lakhs of Rupees)

	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	
Bangles	...	89.5	76.8	85.2	49.9	34.5	39.9	27.1	31.1	27.2	28.0	29.3	24.2	18.4	6.9
Beads and false pearls	...	26.6	30.4	30.6	15.7	9.4	12.4	13.4	13.1	15.3	12.2	18.9	13.4	8.5	3.5
Bottles and Phials	...	33.0	36.2	39.5	29.9	24.1	24.4	21.1	24.8	30.2	23.6	29.3	28.0	20.6	24.8
Bottles and Phials Gross (lakhs)	...	...	...	7.0	6.2	4.6	8.1	7.9	8.3	10.4	8.5	11.9	9.8	...	...
Lampware,	...	22.2	19.6	21.1	12.3	7.5	6.7	5.1	5.7	6.0	6.1	6.9	5.2	3.8	2.0
Scientific Glassware	...	1.7	1.7	1.3	1.4	1.2	1.4	1.2	.9	.7	1.5	1.9	1.9	...	...
Sheet and Plates	...	29.9	29.7	31.0	23.9	19.7	23.1	21.2	23.7	24.3	21.3	25.4	23.7	19.9	17.5
Sheet & Plates sq. ft. (lakhs)	...	...	...	222.0	198.0	157.5	186.2	195.4	247.6	309.2	273.3	210.1	270.7	...	...
Tableware	...	9.4	10.9	13.3	9.5	5.9	5.4	5.3	5.5	4.6	4.5	6.0	5.9	...	...
Other glassware*	...	36.1	32.3	29.9	22.2	19.6	29.2	27.7	27.7	31.1	30.8	34.2	22.9	30.6	31.6
TOTAL	...	248.4	237.5	251.9	164.8	122.0	142.5	122.1	132.6	139.4	127.9	151.4	125.1	101.8	86.3
Electric Bulbs**	...	...	...	...	...	35.3	36.0	34.3	38.0	39.9	33.0	89.8	28.0	26.3	21.6

\*Electric Lamp Bulbs are not included.

\*\*Figures available from 1931-32. The cost of the glass shell is of course only a fraction of that of the electric bulbs.

**STATEMENT No. 4**

**PERCENTAGE OF VALUE OF GLASSWARE IMPORTED FROM DIFFERENT COUNTRIES IN 1929-30 AND 1938-39.**

	Czechoslovakia		Japan		Germany		British Empire		Belgium		Others	
	1929-30	1938-39	1929-30	1938-39	1929-30	1938-39	1929-30	1938-39	1929-30	1938-39	1929-30	1938-39
Bangles ...	65.4	39.1	29.3	54.1	2.0	1.8	...	2.1	...	...	2.4	3.8
Beads and false pearls	37.1	32.8	30.5	36.3	5.7	6.7	...	...	...	...	26.4	25.1
Bottles—Sodawater-bottles ...	...	...	...	64.4	46.8	20.7	46.3	18.0	...	...	6.9	.9
Other bottles and Phials ...	...	5.1	55.8	64.0	20.4	20.3	16.1	6.6	...	...	7.7	4.0
Lampware ...	5.6	15.5	11.2	13.7	44.8	48.9	...	8.1	6.5	...	31.9	13.8
Scientific glassware	...	...	9.2	20.7	56.6	57.0	25.9	18.6	...	...	8.3	3.7
Sheet and Plates ...	6.2	2.9	5.4	30.2	5.0	12.3	16.2	12.2	60.5	40.6	6.7	1.8
Tableware ...	2.1	5.8	68.0	72.2	8.7	6.8	7.0	10.3	11.4	...	2.8	4.9
Other kinds ...	...	4.8	43.4	52.1	19.1	10.9	18.1	16.0	6.6	...	12.8	16.2
All sorts ...	28.4	14.3	29.4	48.0	13.6	13.4	9.5	8.0	9.4	7.7	9.9	8.6

**STATEMENT No. 5**  
**MECHANICAL ANALYSES OF SANDS (Sieve test on a. s. t. m. mesh sieve)**

		Percentage fraction of sand					
Origin of sand.	1.	2	3	4	5	6	7
		Retained on 8 mesh sieve	Passing 8 mesh but retained on 16 mesh	Passing 16 mesh but retained on 30 mesh	Passing 30 mesh but retained on 50 mesh	Passing 50 mesh but retained on 100 mesh	Passing 100 mesh
<b>U.P. SANDS</b>							
Bargard	...	...	0.07	1.87	11.85	70.00	16.21
Bargard	...	...	...	0.03	7.50	77.50	14.97
Bargard	0.04	...	2.15	4.00	11.50	63.15	19.16
Bargard	...	...	0.10	0.20	3.51	83.76	12.43
Bargard	...	...	0.19	2.65	7.40	61.25	28.51
Bargard	...	...	0.01	2.35	9.75	77.50	10.49
Panhai	0.2	...	17.7	7.8	7.6	31.1	35.6
Panhai	...	...	2.8	7.8	47.7	33.6	8.1
Lohagra	...	...	3.7	5.90	19.20	60.70	10.5
Lohagra	...	...	0.8	1.8	12.8	73.6	11.0
Dabhansa	...	...	0.1	4.02	7.20	76.00	12.68
<b>JUBBULPORE SANDS (C.P.)</b>							
Jubbulpore	...	...	2.74	4.25	43.74	37.74	11.47
Jubbulpore	...	...	...	5.40	41.50	48.00	51.30
Jubbulpore	0.09	...	2.90	3.25	39.00	42.55	12.21
Jubbulpore	0.40	...	4.51	4.72	35.71	45.60	9.06
<b>BOMBAY PRESIDENCY</b>							
Walwall Hills	0.4	...	0.6	23.8	37.1	27.7	10.4
Ghodega	...	...	0.4	12.7	32.5	36.0	18.40
<b>BIHAR (SANTHAL PARGANAS)</b>							
Mangalhat (Hadap Hill Quarry East.)	...	...	0.8	7.6	38.7	21.1	6.4

STATEMENT No. 5 (Contd.)

1	2	3	4	5	6	7
Mangalhat, (Hadap Hill Quarry North.)	3.0	30.2	27.6	18.0	18.1	3.1
Mangalhat, near Bengalow	0.7	6.6	9.7	30.8	38.4	13.8
Mangalhat, sampled from factory stock	5.0	32.8	14.6	36.8	10.3	0.5
Mangalhat, washed	...	0.1	14.6	38.5	39.8	7.0
MADRAS PRESIDENCY						
Ernavur	0.1	8.9	21.6	36.8	29.5	3.10
Chirala Surface layer	...	3.4	34.5	32.5	24.0	5.6
Chirala lower state	...	0.8	11.8	37.0	46.1	4.8
Baptala	...	0.1	1.5	15.3	76.1	7.0
TRAVANCORE STATE						
Kakothamangalam Shertallai	...	0.75	9.35	32.75	48.75	8.20
Kizhakummuri	...	2.99	16.97	44.20	11.79	24.10
Thuravoor	...	0.71	6.37	42.32	46.78	3.92
Vylar	...	1.35	17.40	42.00	33.05	6.20
PALLANAKAD Kamppan	...	1.5	14.25	40.75	37.00	6.50
Kalagara	...	1.10	8.90	38.00	49.50	2.50
Thirumallor	...	0.90	13.10	45.90	34.00	6.10
Chinnampalipuram	...	1.24	9.25	32.25	48.75	8.51
Palipuram	...	1.15	14.76	30.60	45.75	7.74
Allipuram	...	0.40	9.43	40.46	43.75	5.96
Thycattisiri	...	1.95	11.40	24.88	27.94	33.83
Panavelli	...	1.05	15.08	31.35	46.45	6.17
Panavelli	...	0.35	6.60	27.10	56.25	9.70
Marangurvattam	...	0.85	16.25	56.45	24.07	2.38
Kaluar	...	1.01	18.25	57.7	44.52	1.34
Rasikan Kannu	...	...	2.73	46.62	44.52	6.13
Rasikan Kannu	...	...	3.39	48.01	43.24	5.33
Rasikan Kannu	...	0.03	1.51	19.75	72.10	7.62
Rasikan Kannu	...	0.02	2.42	21.71	68.73	7.14
HYDERABAD STATE						
Deccan (Nalwar Nallah)	...	0.20	18.80	43.90	33.8	3.30
MYSORE STATE						
Talalad	...	...	2.1	19.9	93.6	14.1

STATEMENT No. 5 (Contd.)

1	2	3	4	5	6	7
RAJPUTANA STATE						
Swai Madhopur	...	0.04	2.80	29.23	49.40	18.53
KASHMIR STATE						
Dan Talav	...	0.40	12.60	42.10	22.00	29.90
PUNJAB						
	Retained on 16 mesh	Passing 16 mesh but retained on 30 mesh	Passing 30 mesh but retained on 60 mesh	Passing 50 mesh but retained on 100 mesh	Passing 100 mesh	
Ghaggar	0.1	0.0		0.5	54.0	45.40
Jeijon Doaba No. 1	...	2.3		47.8	39.4	10.5
Jeijon Doaba No. 2	0.03	8.48		31.00	44.20	16.29



**STATEMENT No. 6**  
**CHEMICAL ANALYSES OF SANDS**

Origin of Sand	Moisture	Constituents of the Dried Samples									
		Loss on ignition	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O + K <sub>2</sub> O	Total	
1.	2	3	4	5	6	7	8	9	10	11	
UNITED PROVINCES											
Bargarh ...	0.12	0.60	96.70	0.06	0.12	1.65	0.30	0.27	0.17	99.87	
Bargarh ...	0.10	0.70	96.57	0.03	0.18	1.73	0.30	0.27	0.05	99.83	
Bargarh ...	0.21	0.85	95.84	0.04	0.16	1.53	0.83	0.19	0.70	100.14	
Bargarh ...	0.21	0.62	97.10	0.03	0.12	1.09	Trace	0.16	0.80	99.92	
Bargarh ...	0.19	0.45	95.70	0.10	0.12	2.85	0.30	0.19	0.26	99.97	
Bargarh ...	0.25	0.85	95.65	0.07	0.22	1.98	0.42	0.48	0.30	99.97	
Panhai ...	Trace	0.30	94.75	0.13	0.04	3.31	0.23	0.22	0.95	99.93	
Panhai ...	0.02	0.40	97.92	0.03	0.02	0.83	0.16	0.18	0.50	100.04	
Lohagra ...	Trace	0.37	98.86	0.05	0.01	0.61	0.10	Trace	0.05	100.05	
Lohagra ...	0.02	0.43	98.02	0.06	0.07	0.64	0.20	Trace	0.30	99.72	
Dabhaura ...	0.00	0.51	97.50	0.05	0.08	0.76	0.20	0.35	0.30	99.75	
PUNJAB											
Chaggar ...	0.35	1.71	89.31	4.27	0.40	2.44	1.08	0.47	0.75	100.49	

STATEMENT No. 6 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11
JUBBULPORE (C.P.)											
Jubbulpore		0.22	1.05	94.05	0.06	0.38	3.65	0.50	0.28	Nil	99.97
Jubbulpore		0.12	0.63	96.60	0.04	0.28	1.57	0.20	0.47	Nil	99.73
Jubbulpore		0.47	1.78	96.25	0.06	0.08	0.83	0.18	0.28	0.57	100.03
Jubbulpore		0.20	1.35	95.15	0.04	0.20	2.57	0.10	0.21	0.36	99.98
BOMBAY PRESIDENCY											
Ghodega		Trace	0.65	93.67	0.49	3.00	0.30	0.68	1.01	0.05	99.85
BIHAR											
Maugalhat		0.02	0.30	99.00	0.14	0.25	0.39	Trace	Nil.	Trace	100.08
Maugalhat		0.03	0.45	97.83	0.17	0.41	1.10	Trace	Nil.	Trace	99.96
Maugalhat		0.10	0.55	97.08	0.30	0.65	1.53	Trace	Nil..	0.23	100.34
Maugalhat		0.16	0.54	99.08	0.05	0.08	0.33	Trace	Nil.	Trace	100.80
Maugalhat		Trace	0.57	97.65	0.05	0.33	1.10	Trace	Nil.	0.20	100.23
MADRAS PRESIDENCY											
Ernavur		0.17	0.27	96.29	0.15	0.16	1.89	0.62	0.17	0.14	99.69
Chirala		0.23	0.44	91.44	1.17	0.20	6.67	0.34	Trace	Trace	100.26
Chirala		0.15	0.37	90.40	0.74	0.14	5.69	1.83	0.50	Trace	99.67
Baptala		0.14	0.36	90.70	1.45	0.40	4.78	0.24	0.18	1.87	99.98

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	1	2	3	4	5	6	7	8	9	10	11
TRAVANCORE											
Kakothamangalam Shertallai		Nil.	0.20	95.90	0.24	0.88	2.40	Nil.	0.40	0.20	100.22
Kishakkummuri		Nil.	0.45	95.05	0.21	1.12	2.72	Trace	0.27	Trace	99.80
Thuravoor		Nil.	0.50	98.70	0.32	1.16	3.07	0.50	0.26	Nil.	99.51
Vylar		Nil.	0.32	95.03	0.13	0.80	3.32	Trace	0.19	Trace	99.79
Pallanattad Kamppan		Nil.	0.41	97.65	0.04	0.36	1.00	0.15	0.32	Trace	99.93
Kalangara		Nil.	0.30	97.25	0.08	0.56	1.61	Trace	0.21	Trace	99.99
Thirunalloor		Nil.	0.30	96.85	0.17	0.96	1.07	0.25	0.25	Trace	99.85
Chinnarpattipuram		Nil.	0.32	96.40	0.12	0.28	1.05	0.35	0.43	0.62	99.57
Pallipuram		Nil.	0.45	95.29	0.16	0.52	1.57	0.25	0.36	0.25	99.85
Alipuram		Nil.	0.20	97.55	0.05	0.48	1.47	Trace	0.31	Trace	100.06
Thyettusseri		Nil.	0.35	97.15	0.05	0.20	1.36	Trace	0.36	Trace	99.47
Panavalli		0.06	0.30	95.90	0.10	0.32	3.28	Trace	Trace	0.12	100.02
Panavalli		0.03	Trace	95.50	0.14	0.36	3.00	Trace	0.20	0.10	99.30
Marungirwattam		0.05	0.20	94.70	0.67	1.96	1.47	0.30	0.30	0.10	99.70
Kalavur		0.04	0.20	96.40	0.24	0.76	0.80	0.50	0.43	Trace	99.35
Rasikan Kannu		Nil.	0.25	96.80	0.46	1.40	1.02	0.11	0.34	Nil.	100.02
Rasikan Kannu		Nil.	0.45	96.50	0.35	0.60	0.60	0.25	0.39	0.20	99.49
Rasikan Kannu		0.05	0.10	92.20	1.10	2.76	3.04	Nil.	0.42	0.10	99.72
Rasikan Kannu		0.06	0.01	95.30	0.42	1.09	2.58	Nil.	0.40	Trace	99.80

I	2	3	4	5	6	7	8	9	10	11
				HYDERABAD STATE						
Deccan (Nalwar Nullah)	0.32	1.45	85.44	0.58	0.06	7.97	1.94	0.58	2.08	100.10
				MYSORE STATE						
Talakad	0.05	0.46	85.48	0.45	Trace	9.48	1.24	0.84	2.18	100.13
				RAJPUTANA STATE						
Swai Madhopur	2.0	0.60	96.30	0.07	0.16	1.98	0.25	0.29	0.24	99.95
				KASHMIR STATE						
Ban Talau	1.98	2.87	75.40	3.35	0.58	12.35	1.14	0.76	3.44	99.89

*Note:—*The above tables (Statement to No. 5+6) have been compiled from the so far unpublished work on "Survey of raw materials for glass manufacture in India" carried out in the laboratories of the Industrial Research Bureau, Calcutta, during the period 1936-40. Publication of the full report has been delayed due to war time conditions and is expected to be undertaken shortly.

**The analyses relate to washed Sands.**



सत्यमेव जयते