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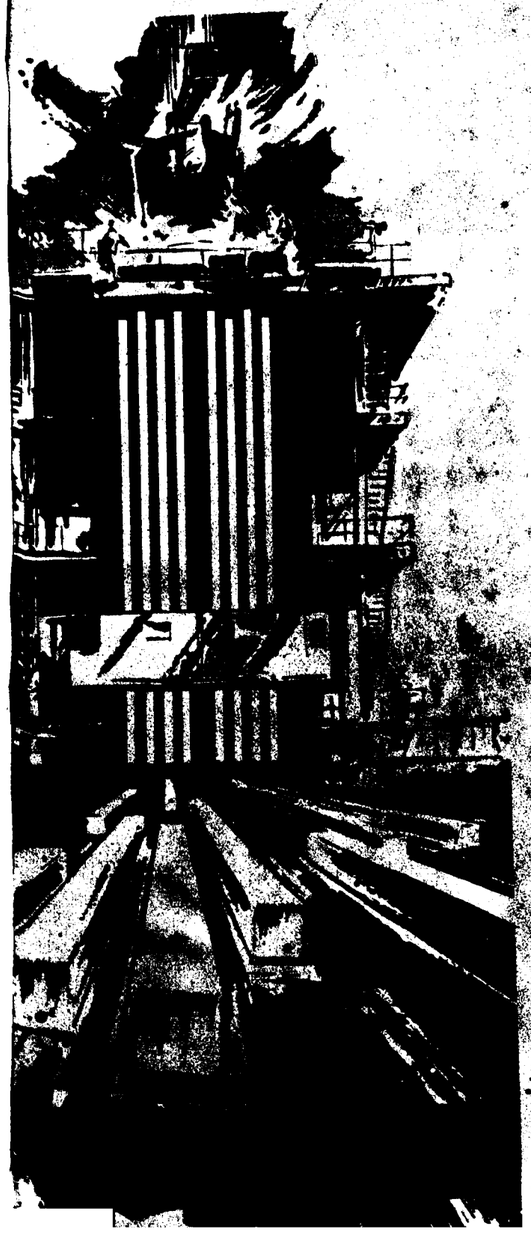

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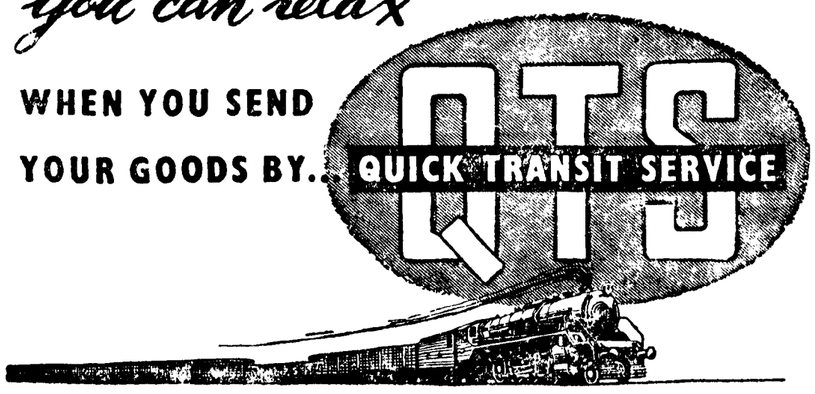

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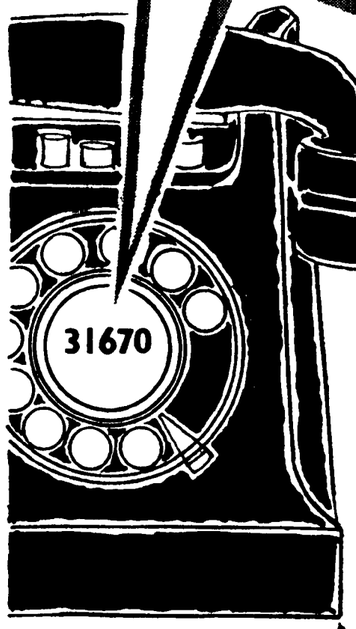


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# INDIAN INDUSTRIES

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The Editor is pleased to consider contributions of interest to the Indian Industry.

Articles should be accompanied by photographs wherever possible and a stamped addressed envelope should be enclosed for return in the event of unsuitability.

Trade notes and short news paragraphs are always welcome.

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# The Sentence of the Watchers

To catch up with the long arrears of stagnation and lost opportunities and reorder the economy were the first concerns of our Planners in 1951. After nearly a century of modern railways, ports and exports industries, after a hundred years of Indian enterprise in a vast sub-continent, the industrial workers in India were barely two millions, steel output a negligent million tons and agrarian economy tragic. Poverty and pressure of population spell disaster at every stage of planning. Self-sufficiency in heavy industry and food alone will save the state from being flung to the iry winds. Tea, jute and cotton textiles—the three staples—are not capable of violent expansions. Heavy industry is the greatest multiplier in any economy. More steel fed into the channels of growing engineering industries—they show signs of dynamic growth—expands the economy in all dimensions. In the second front, power, transport and excellent technical personnel represent the infrastructure. Here in India we are lucky. The physical resources needed for industrialisation are abundant—largest iron reserves, manganese, bauxite, enough coal and untapped hydroelectric power (only 8 per cent has been developed so far).

As our Prime Minister repeatedly says that a heavy industrial base is the need of the hour, the Rs. 20,000 crores we spend for three Plans is not a stupendous sum for a nation of about five hundred millions. American private enterprise, for an economy of some 180 millions, spends over Rs. 15,000 crores a year. India must invest more, to catch up with the rest of the world. We cannot try to equal the "great leaps" claimed by China because our advancement pace is more democratic—valuing individual's freedom more than any thing, a rare phenomenon in a militarised Asia.

Slow but sure, our industrial production has risen by 120 per cent in a decade. But spectacular rises are registered in iron and steel 63%, chemicals 114%, machinery 324%.

Indian Industry can today produce practically all the components of a sugar mill and plan a fertilizer factory. Tata's diesel trucks are 90% Indian manufactured. Industrial boilers, milling machines, diesel road rollers, newsprint, DDT, sulpha drugs are just a few of the items produced for the first time in this country. Small-scale industries are growing at a tremendous pace. There is vigorous Government stimulus to investment. India is repeating the experience of France under the Monnet Plan.

Public Sector has reached a new high in steel-making, power, vital sections of transport and heavy industries.

Six-and-a half million new jobs outside agriculture have been created in the past decade. A

further 10½ millions will be provided jobs in the next five years. There is yet more to be employed but we need more investments to wipe off their distress. Labour force is growing. His skills are being quickly developed. In the Hindustan Machine Tools Plant in 1955, four Indians were needed to do the job of a Swiss worker. Today, three Indians can equal the output of two Swiss. At Jamshedpur it took six of Tata's workers to equal one German's output on similar work for Mercedes at Stuttgart; now the ratio is 6:5. When Integral Coach Factory at Perambur began to produce railway coaches in 1954, it took 19,648 Indian man hours to finish one carriage, compared with the Swiss figure of 6,500. Today the Indian figure is 8,519 hours, and is still falling. Indian coaches cost 20% less than Swiss coaches.

Thus in a decade, Indian Industry achieved spectacular victories. Sons of Managing agents are taking degrees in technology instead of exploiting nepotism. Real talents are entering business houses. Management associations are formed at all industrial centres. Labour management relations have changed. Government itself is an entrepreneur. The public sector in India is passing through an entrepreneurial revolution. Private enterprise is complementany to public sector. Public capital is put at the disposal of business through financial institutions like Indian Finance and Credit Corporation. New enterprises are encouraged by larger rebates. Since 1957, all imports of consumer goods have ceased. Government is taking note of the grievances of industrialists—the "seventy hurdles" they catalogue with a grin. The expansion of steel and cement production will relax licensing of new enterprises.

India needs aid, enormous foreign aid till she arrives at the takeoff stage. As Carnegie Corporation scholar sums up very pensively :

"Today the time has come to take up again the threads dropped so casually a decade age, to restore the Marshall approach as the operating principle in Western policy and apply it at once in a new co-operative venture with Asia's greatest democracy to ensure the success of India's Third Plan. This is the best and most immediate chance open to the West to make operative in world affairs the deepest moral convictions of western life. Behind the Indian figures and statistics lie the realities of children without bread, men without work, women without hope. If these do not move us to action, the outer form of our society may survive—but its inner spirit will have withered away. Then like the myriad proud civilizations upon which "the Sentence of the Watchers" has already gone forth, we shall be carted off this great stage of the world into the dust and debris of history, there to join the melancholy line of past societies which, at the crucial test, could not change and advance in time. It is our fortune at this point of crisis to have all the physical resources that are needed to create a new world of opportunity. It is our tragedy that we lack the vision and will."

Krishna Srinivas


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Sri K. Kamaraj, Chief Minister, Madras State cut the first sod for the Salem–Bangalore rail link. Dr. P. Subbaroyan and Sri Karnail Singh, Chairman, Railway Board were also present.

*Mr. Igor J. Karassik*

Mr. Igor J. Karassik is an application engineer and is the electric power expert of Worthington Corporation, U. S. A. (represented in India by the Blue Star Engineering Company).

Born in Russia, he emigrated to Turkey in 1919, then to Paris in 1924, where he graduated from high school. Coming to the United States in 1928, he received his B. S. and M. S. degrees from Carnegie Institute of Technology, having specialised in research work in the field of hydro-aero-dynamics.

He was employed by Worthington in 1934, as assistant to the Consulting Engineer on Centrifugal Pumps and was engaged in research and multi-stage pumps. Since 1936, he has specialised in the application of multi-stage high-pressure pumps, especially for power stations. His work has also included development and design of improved boiler feed cycles for central station power plants, a field in which he holds several patents.

He has written numerous articles on centrifugal pumps for technical publications. Even as early as April 1950, a total of 116 articles had appeared. In 1940, 1942 and again in 1944 he received the first prize in the Hydraulic Institute Engineering Essay Contest. To-date, he has published a total of 287 articles in seven languages and is the co-author of two books on the design, application and maintenance of centrifugal pumps. He is a member of the American Society of Mechanical Engineers.

Mr. Karassik will be visiting Madras in the second week of March and will address the Madras Institute of Engineers (Madras Centre) in Adams Road, Chepauk, on March 13.

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# The Future of Steam Power

**Igor J. KARASSIK**
Consulting Engineer and Manager of Planning, Harrison Division, Worthington Corporation (U. S. A.)

Novelty has always held the attraction of glamour. This is even more the case today when nuclear power production has passed from the laboratory stage into practical reality. Fission power, fusion power, and direct conversion of nuclear reactions into electricity all beckon to the electrical production industry with the glow of soon-to-be- fulfilled promise.

Does all this mean that the conventional steam power plant with which we have become so familiar is obsolete or becoming obsolete? What about hydroelectric power? Will it continue to hold its present edge over steam power in Latin America? And what effect will already discernible trends have on the equipment in the Fluid Handling Group of the steam power plant, such as condensers, condensate pumps, circulating water pumps, deaerators, boiler feed pumps and the like?

The promise of nuclear power certainly does not mean the end of steam power. Even in the U. S., where financial considerations favour the early development of nuclear power, it is unlikely that more than 5 per cent of all electric power will come from nuclear plants in 1975.

All the indications are that hydroelectric power will steadily lose its importance as a major component of power supply in Latin America. The reason for this is simple. Most of the readily accessible hydro resources have already been developed. Undeveloped sites are generally too far from existing industrial centers to make their development economically practical.

The future, then, will clearly see an increase in the installed capacity and kilowatt-hour production of steam power plants in Latin America. Just how great the increase will be is difficult to say, but reliable estimates place the total installed steam power capacity of Latin America at 30,000,000 KW in 1969—a 100 per cent increase over present levels. If anything, this 100 per cent increase estimate is too low, because installed capacity has been gaining at this same rate in the U. S. during a period not marked by the kind of industrial growth that seems so certain in Latin America.

### The Fluid Handling Group

As far as the future of fluid handling equipment goes, some current trends will have little influence on Latin America; others will have a considerable effect. These trends and the degree of their impact on fluid handling equipment are summarized in Table I. A few comments may be in order in connection with the effect of these trends.

Along with the expected increase in installed capacity is a trend towards larger size steam power and fluid-handling equipment. For instance, one major utility company operating in several Latin American republics, EBASCO International, is giving serious consideration to the installation of units rated at from 100,000 to 150,000 CW in the next few years. They have already installed steam power equipment rated to 66,000 KW. Ten years ago EBASCO was installing units ranging in size from 2500 to 7500 KW on the average, with its largest installation of a decade ago having been only 30,000 KW. This means that the maximum size of EBASCO's units has doubled during the past ten years and will probably double again within the next few years.

This trend towards bigness of individual units and larger plants has its distinct advantages for Latin American countries. It frees the production of power from the limits of available, trained personnel. This is because the size of operating and maintenance crews is, for all practical purposes, independent of unit or plant size.

One important factor which encourages the use of larger and larger units in Latin America is that the rapid growth of capacities enables public utilities not to pay too much attention to the 10 per cent rule of thumb which governs the size of steam power units in the U. S. This rule, stated simply, means that no single power generation unit should be designed for more than 10 per cent of the total capacity of the entire system. The reasoning behind this is that failure of a single unit might otherwise make it impossible for the system to meet peak demands. It also covers the reduction in production caused by taking units out of service for annual inspections or overhauls.

In Latin America, such a rule would have little sense, as 10 per cent of capacity today is likely to be only one per cent of capacity next year in some systems. In other words, the picture is too fluid to make the arbitrary 10 per cent limitation meaningful.

The growth in the size of the individual units will be obviously reflected in the size of the condensers, condenser auxiliaries, deaerating heaters and boiler feed pumps. For instance, steam surface condensers are increasing rapidly in size to keep pace with turbo-generator size growth. An example of this growth is shown by the fact that in 1951 the average size steam condenser furnished by Worthington Corporation for central station use contained approximately 44,000 square feet of surface. In 1957, the average size had jumped to 95,000 square feet, including three single shell units each containing 135,000 square feet.

**Outdoor vs. Indoor**

Regarding the choice of outdoor versus indoor locations of steam power plants, there still is considerable controversy. Indoor installations will probably remain more practical in tropical areas in Latin America, because they simplify maintenance during the rainy season. Where outdoor or semi-outdoor plants are used, the use of flatter, lower head-room condensers will be favored. In a few marginal cases, the scales may be tipped in favor of condenser deaeration and elimination of deaerating heaters. This, however, is a questionable decision, since the heaters can be readily located on the boiler structural work and therefore no extra expense for structural would be involved.

Along with a trend toward bigger units, there is a trend toward higher operating temperatures and pressures in steam power plants. The purpose here, of course, is to increase the efficiency of the cycle and to decrease the cost per kilowatt-hour. The experience of a leading utility reflects this trend. Prior to 1940, the maximum operating conditions of its steam plants were 400 psi and 750 F. The 150,000 KW units now considered for the future will in all probability operate at pressures of 1,800 to 2,000 psi and at 1000 F with F 1000 F. reheat. The only serious limiting factor on both temperatures and pressures is the availability of trained personnel to install and maintain high temperature-pressure systems.

**Effect of Higher Pressures**

Higher operating pressures will tend to favor the trend to higher speed boiler feed pumps, since they cannot be met at the conventional 3600 rpm speed without some sacrifice in reliability. This is because the increased number of stages required at 3600 rpm increases shaft deflection and reduces the margin between deflection and internal clearances. Once-through boilers, which further contribute to higher operating pressures, will likewise dictate a trend towards high speed boiler feed pumps. This type of boiler will also affect condenser and deaerating heater design because it places an increasing emphasis on condensate and feed-water purity and because it introduces the problem of occasional "steam dumping" to the condenser in very large quantities.

In general, it may be said that any major variation in the steam cycle in terms of more "sophisticated" arrangements will materially affect the Fluid Handling Group equipment, in that "sophistication" can only be achieved through major advances in the ability of this equipment to meet the constantly growing severity of operating conditions with no sacrifice in reliability.

TABLE I

EFFECTS OF STEAM POWER PLANT TRENDS

| Trends | | | | Degree of Effect on Fluid-Handling Equipment |
|---|---|---|---|---|
| Larger turbo-generator units | ... | ... | ... | Major |
| Larger individual power plants | ... | ... | ... | Minor |
| Possible growth of power grids | ... | ... | ... | None |
| Better transmission methods | ... | ... | ... | Minor |
| Increasing popularity of outdoor plants | ... | ... | ... | Major |
| Higher operating pressures and temperatures | ... | ... | ... | Major |
| Advances in design of boilers and turbines | ... | ... | ... | Major |
| More "sophisticated" steam cycles | ... | ... | ... | Major |

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**( ISSUED BY THE SOUTHERN RAILWAY )**




# Human Engineering

**Dr. O. W. J. GILBERT**
Operational Research & Cybernetics Department,
United Steel Companies, Ltd.

The trouble with man is that he is so very adaptable. Hot or cold, wet or dry, monotonous or exciting, human beings, men and women, usually cope with their jobs. In industry, unfortunately, this human resilience and adaptability is too often taken for granted. We've come a long way since the factories of Dickens; the canteens are marvellous, the bowling greens are a delight... but why can't the crane driver see what he's lifting without hanging precariously form his cab? And why is that typist's desk at an uncomfortable height? And why is that dial so difficult to read? Under normal working conditions jobs get done, but often not as effectively as possible, and certainly not as conveniently as possible, because they put a greater-than-necessary demand upon the worker.

It was during the Second World War that the problem of fitting the task or the machine to the man started to be explored with zest. These investigations were team affairs, in which engineers worked with human biologists — anatomists, physiologists, experimental psychologists. A few years after the war some of those who had worked on Service problems, got together and started the Ergonomics Research Society.

**'Laws of work'**

They concocted "Ergonomics" (literally "the laws of work") because they required a word that was both new and neutral. The American phrase for the same thing is Human Engineering which for me always conjures up fittting the worker by surgery! Ergonomics, at least, does not do that. Ergonomics stems from the belief that the most valuable component of industry is man-power, and that, therefore, in the long view, it pays to consider man's (and woman's) particular attributes his capacities, his shortcomings and his need and to design work accordingly. This is in fact, a broader concept than fitting the job to the worker; it includes studying the whole work system and deciding what can be best done by machine and what by man.

A catalogue of ergonomic "do's" and "don'ts" look uncommonly trite: a chair should support the small of the back; sufficient clearance should be allowed beneath a desk for the thighs; controls should be accessible; dials should be easy to read; warning signals unmistakable; and so on. But how often are these simple points disregarded; how many time in a day do we use, or see in use, equipment designed for man but not designed with man in mind!

**Giants or dwarfs?**

In steel works, as indeed, through much of industry, cranes are key pieces of equipment. None the less the driver can see his load only by standing up and leaning forward. He can use the controls and simultaneously see the load only if he stretches his arms behind him. Crane drivers must find their cab seats a great boon when they are not working!

Much has been done over the last few years by the British Iron and Steel Research Association to design steel works crane cabs which enable the drivers to see the load while sitting down and at the same time, to have the controls within easy reach. This investigation was long and painstaking, and bearing in mind how many cranes are in use it cannot help but be rewarding. The principles employed in the design of steel works crame cabs are applicable to all working positions, to cars, to kitchens and to control rooms. The sort of considerations involved are:—

Is the working position comfortable after prolonged use?

Are the controls most frequently used within easy reach?

Is anything hidden from view which needs to be seen?

Is the work place suitable for persons of a wide range of stature, or are giants (or dwarfs) required?

We are all so familiar with the rotating shift system of working that few of us pause to wonder how well the human constitution is fitted to it. Our body temperature has a daily rhythm, with the peak during the afternoon and the low point during the early morning. Unfortunately men newly on the night shift have the same rhythm, which makes them want to sleep when they're at work and want to work when they hope to sleep. After about a week the rhythm inverts and their lowest ebb comes in the afternoon. By this time, under most shift systems, they then return to days. There is no doubt that this disregard for human physiology adversely affects industrial efficiency. The cure, unfortunately, is not as straightforward as the diagnosis—long periods "on nights" would be very unpopular. Probably two or three weeks on nights, instead of one would be a compromise rewarding to both employee and employer. Some people, such as nurses, already have much longer periods of night work.

**Having a rest**

Physically exacting work is decreasing rapidly in British industry. Few jobs are now as arduous as, for example, the teemer's in the early days of steelmaking, when few men reached the position before 40 years of age and few had the stamina to continue beyond their early fifties. Certain jobs, however, do still take a considerably physical toll. Furnace repair and furnace dismantling prior to rebuilding are such jobs. Men enter the furnace while the walls are still very hot. Under these conditions it is a case of five minutes' feverish work and 10 minutes' rest. Research is going on to provide clothing which will improve the working conditions. At the other extreme, special clothing is also required for that increasing band of people working for long periods in refrigerated warehouses.

Man's physiological limits are rarely exceeded at work. Heavy physical work demands compensatory rest and this is usually taken, ableit sometimes without the foreman's or the management's explicit approval. One feature of this rest which is often overlooked in orthodox time study is that rest pauses, to be truly effective, must be spread over the working day. Five minutes' rest taken every hour is better than 40 minutes taken at the end of the shift. Experiments in Germany have shown that enforcement of hourly rest pauses can increase production.

The impact of experimental psychology on ergonomics has been especially fruitful. March of the research work, particularly in the field of vigilance, has been sponsored by the armed Services. Information about the limitations of persons monitoring radar screens is of vital defence interest. The task of the radar operator is the same, in essence, as that of people in control rooms throughout industry. In both instances the cues for action come unexpectedly and infrequently, and they are easy to miss. Many industrial inspection tasks are similar. Experiments show that, after half an hour, performance at such tasks falls off dramatically. The capacity for other work is, however, not impaired and when a vigilance task lasting half an hour is alternated with another task of similar length, a high performance is maintained throughout.

**No confusion, please**

The key to vigilance situations is that the observer must have his senses stimulated to a certain extent; below this threshold of monotony he can remain alert only for short periods. At the other extreme, the "channel capacity" of the



sensations can quite easily be overloaded. This happens all too frequently in emergency situations, causing mistakes, which are often costly and sometimes fatal.

There is, therefore, a great onus on designers to make controls and instruments which cannot be confused in an emergency. How slowly findings in this field penetrate is shown by the altimeters used in aircraft. Over 10 years ago it was shown that more than 10 percent. of readings on the standard three-pointer altimeter were in error by 1,000ft. or more. Yet the three-pointer altimeter is still in use. Luckily reading most industrial dials, often difficult enough, is not so fraught with disaster. The principles governing good indicator design are now firmly established and the standard of indicators on machines is fast improving.

Much of what we know as skill is the ability of the worker to select, quite unconsciously, the important sensory, cues from a host of irrelevant sensations. Training for skilled jobs is a matter of recognising these important cues and learning how to act upon them. The analysis of the sensations which trigger action is a recent study, but one which is paying off handsomely in training for manual skills. A striking example is the investigation sponsored by the Wool Textile Employers' Council into the training of "invisible menders" of woollen cloth. Analysis showed that the trainee's major problem was to recognise the weave. In the revised method of training, one of the pupil's first tasks is to learn to recognise various weaves by constructing them with elastic thread. Such methods of training, based on an analysis of the trainee's need, are much more rapid than the traditional method "of sitting next to Nellie."

**By stages**

Another aspect of training is the need to split up the task into short elements which can be learned separately, and later practised together. The early stages of learning rely on our short-term memory, the sort of memory we use when we step from the directory to the phone. This short-term memory is a frail thing indeed. It is one of the weak links not only in training but also in maintenance of work performance with age. It is easily distracted, it is easily overloaded, and it dulls inexorably as we grow older. The impairment of short-term memory with age makes older people more difficult to train. It also means that they are able to make mental calculations less readily. However, if their special needs are realised, their training can be as successful as that of younger people.

Strangely, older people often find refuge in manual work. It is apparently easier as retirement age approaches to shift from a light job to a heavier job which is mentally less demanding, than to make the reverse change. A change from heavy manual work to inspection, at first sight a most suitable transfer for the older worker, may prove particularly distressing. Older persons also find paced tasks difficult, whether the pace-maker is a machine or a group of younger workmates. The working characteristics of older people are becoming increasingly well known, and it up to industry to use this knowledge to make full use of the skill and experience of our ageing labour force.

**Design engineer**

The only constant feature of ergonomics is the interrelation of the worker and his work. The disciplines used to illuminate this relationship are very varied, so varied in fact that one wonders if the all round "ergonomist" as such a person might be called, can really exist. Who then, in industry shall be responsible for the application of ergonomics?

Clearly, there are several interested persons—the medical officer and the safety officer are two of them. Taking the broad view, it is the concern of everyone in industry to see that human energy, be it mental or physical, is used wisely. The main brunt must however be borne, on the one hand, by the design engineer who will make sure that the equipment he designs makes the most of the people who will use it, and on the other by the work study and operatioal research practioners who must specify the roles that man should play in the man/machine system.

The day breaks brighter tomorrow

WHERE a child laughs with eyes like the clear rays of sunlight, and the strength of thunder in his limbs...there is a home.

In a home dawns the man of tomorrow. A tomorrow that will bring a little less of care, a little more of joy.

Today and tomorrow...Hindustan Lever serves the home with soaps, foods, toilet preparations.

PR. 21-X52




# Voltas Limited

J. D. CHOKSI
Chairman

This Statement on the Company's affairs rounds off a seven year span in this year of the gathering of the Constellations. Not a long period in the life of individuals, much less of corporations; but nonetheless in the ephemeral world of trade and commerce, to which we belong where fortunes are made and lost every day, it is an innings of respectable dimension.

At this seventh milestone, I propose to describe to you the organisation of the Company, how it works, and enumerate its many-sided activities so that shareholders may have a more clearly defined image of Voltas.

What is Voltas? What do they deal in? A typical answer is: "They are airconditioning people, of course"! This is true as Voltas has become a by-word for airconditioning and refrigeration. However, the important airconditioning and refrigeration department represents only 13% of our gross turnover.

I should describe our Company as firstly and primarily an importing and distributing house. We are not mere selling agents, or even sole selling agents, according to the normal understanding of of that term. We purchase from manufacturers as principals and sell to clients in our own name. We normally hold ourselves responsible not only for selling a product, but also for its erection, where it is plant or machinery, and for elaborate after-sales-service. This is an important side of our activitiies often overlooked. For a buyer, who acquires a piece of complicated equipment, it is important to have the seller provide after-sales service for many years. The legal restriction of a 5 year tenure of distributorship, therefore, is hardly appropriate in our case and should not be made applicable to organisations like ourselves, since most plant and machinery have a longer life than 5 years and can best be served after sale by the manufacturers or their representatives. This is one of those instances where the Company Law ill serves the Indian importing house, which performs services such as ours and discriminates against the Indian importing house in favour of his foreign rivals incorporated abroad.

Marketing and distribution, as far as we can foresee the future, must remain the most important part of our activities, because we are essentially a trading organisation. This trading organisation is divided into two main groups—one 'Engineering' and the other, for want of a better name, called the 'Marketing' group.

The Engineering group consists of 6 independent divisions, each of which handles a range of products

which can be conveniently grouped or brought together into one division and handled as such by the staff of that division. Among these 6 independent divisions are the Airconditioning and Refrigeration division, the Agricultural & Construction Equipment division, the Mechanical division, the Electrical division, the Machine Tool division and the Textile and Paper Machinery division each with its own specialists and technicians serving our nation-wide centres and our clients in the remotest parts of the country.

The Marketing group consists of two main divisions—one dealing in Drugs and Pharmaceuticals and the other in Chemicals. Vitamins and miscellaneous items of general merchandise.

Each of the divisions to which I have referred, while making use of the Company's Central Services, such as Accounts, Publicity, Personnel, Marketing Services, Liaison and Warehousing operates on an all-India basis under the control of General Management. Each division is headed by a manager with wide operating authority, who is fully responsible for the business results of his division. The sales organisation of each division is tailored to satisfy the requirements of consumers. In some divisions, sales are made direct to the end users and consumers; in others, the services of dealers, wholesalers, retailers and stockists, are utilised. The operation of some of these divisions depends on the provision of adequate personnel and facilities for continuous after-sales-service where these are required, since in India reliable service facilities are few or non-existent. Some divisions maintain a fully equipped all-India service organisation to serve the country-wide needs of our clients. The standing and reputation of our Company is due, in large measure, to the excellent after-sales-service provided to clients, large and small, for a wide range of equipment.

The central organisation just described, with its trading divisions is supported by widespread regional service units and stations. For a marketing and distribution organisation of our size and complexity this is essential, if we are to reach every distribution point effectively. We have over the years created and built up a net-work of such regional facilities and services which we believe, is second to none. Its focal points are the large branches at Bombay, Calcutta, Madras, Delhi and Bangalore, which in turn are served by regional offices, area offices and service establishments within the territories of these branches. The branches themselves are again sub-divided into productwise trading sub-divisions. These operate under the control of the branch manager who is the chief representative in the area of that branch within the general framework of the policies laid down by general management and specific policies devised by the divisional managers in regard to the handling of their respective lines and products. Close co-operation is maintained in all important matters, between general management, branches and divisions to achieve speedy and quick service and smooth movement of the of the various complicated parts of the Voltas organisational machine.

**Manufacturing Activities**

I have given you a fair picture of the organisation covering our trading operations in the above paragraphs and I should now like to deal with the other major branch of our activities, namely, manufacture. I repeat what I have said on previous occasions that, in the context of our national Plans, the foreign exchange situation and the development of the Indian Commonwealth of States with-in this Continent of ours, we are firmly convinced of the necessity of promoting local manufacture. We have endeavoured to achieve this objective in one of three ways :

(i) by bringing about collaboration between foreign associates and suitable Indian manufacturers retaining for ourselves the distributorship of the locally made products in succession to the distributorship of the previously imported products ;

(ii) by either ourselves, or our parent body, Tata Sons, associating with other foreign principals as partners in manufacturing ventures ;

(iii) by undertaking certain lines of manufacture ourselves.

Local manufacture has made substantial progress. Many of our divisions have today achieved a position where more than 50% of their business is in products of Indian manufacture, as for instance, Pharma division (94%). Machine Tools (54%). Textile Mill-stores (63%) and Airconditioning (52%).

A programme for transfer and expansion of our facilities and lines of manufacture from the restricted area of Chinchpokli to the new Thana unit has been worked out.

A number of obstacles lie athwart the manufacturing field. A manufacturing licence granted today by the Government does not commit the Government to import essential components and raw materials provided in the phased programme submitted in the licensee's application for manufacture. Consequently, every manufacturer today, who has to rely on even a small amount of imported components and raw materials, lives in constant dread of his requirements being cut substantially if not banned altogether. This is hardly an inducement for the starting up of new enterprises. Even while one appreciates Government's difficulties in the matter of foreign exchange, some way must be found if the country is to progress into ever widening fields of industrial activity. We, for our part, would prefer to see a stricter control over the grant of licences for new manufacturing units, which depend to some extent on imports of components and raw materials, rather than have these licensed in the first instance and then come to grief later for want of essential components or raw materials which can only be imported.

The Company has made steady progress over the last few years both in the trading and manufacturing fields. In spite of severe import restrictions leading to the belief in some quarters that "import houses have had it," we are firmly convinced that there will always be room for a fiexible, well balanced and well organised import organisation in India's economy. We refuse to consider our trading activities as a thing of the past or on the wane. On the contrary, we plan to consolidate and expand our position in this field. We hope retain our pre-eminent position as importers and distributors and at the same time to strengthen our industrial base within the country. New fields, new products and an ever widening horizon with increasing pursuits and activities — that is what sums up Voltas. We look forward to the future with well-founded confidence.


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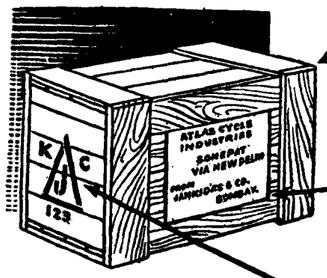


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# European Common Market & India

**Prof. C. L. GHEEVALA**

Secretary, Indian Merchants' Chamber, Bombay

Joining the European Common Market is a compulsion which the U.K. cannot avoid. Particularly after the Second World War with the shrinkage of the Empire and its political power, the consequent effect on her markets and all the implications arising out of that have necessitated that step. Thus, the U.K., for her survival, has no choice but to join the Common Market. India can have us quarrel with this decision.

The other aspect regarding the European Economic Community is that it is not purely an economic community. The main force behind it is political. It is an attempt on the part of these European countries to consolidate themselves against the powerful might of the Soviet bloc. It is, therefore, the social economic and political aspects of the European Economic Community which have to be borne in mind when looking at this problem. It is not merely expansion that they are trying to seek, but also an acceleration of industrial development as rapidly as possible with a view to raising the standard of living of the people in the region.

The U. K. has to live on exports. The markets for the U.K. have shrunk and she has realised by experience that her progress as compared to the European Economic Community and the Common Market countries has been sluggish. For example industrial production between 1952 and 1960 went up in the U.K. by about 30 per cent while in the European Economic Community countries it went up by about 70 per cent. Even in respect of exports, they went up only by 29% for the U.K. while in the Common Market countries they went up substantially by more than 60 to 70 per cent. That being the position, the U.K. which had hitherto prided herself by living in splendid isolation can no longer choose to continue in that isolation, because of the shaking of the Empire. It is a categorical imperative for Britain to join the Common Market. Unless she joins, she cannot have the benefits of an expanding market, which increases the purcharing power, and and all the advantages which follow. Keeping in view the political and social implications, it is not merely going to be a freedom of movement of goods and services, it is also going to be a freedom of movement of manpower and industrial development. A bank has also been established in the region. Therefore, the EEC is an integrated approach to the several problems which have developed in the post-war world in Europe. It is a move which has to be viewed from a much broader angle. We shall examine what would exactly happen to India if the U.K. joins the Common Market.

I do not believe that things will crash the moment the U.K. joins the Common Market. But we have to take a very realistic view of the implications of the U.K. joining the Common Market at this stage of our development, particularly when we have been told that either we have to export or stagnate. We have launched the Third Five-Year Plan. The most crucial problem during this period is that of foreign exchange. Unless we earn enough foreign exchange, our development is going to be retarded. We are yet to develop the internal market with all its infinite potentialities and I share that promise of the future. But today that is not the position. In the present stage of development, unless we export, we will not be able to maintain the industries that we have developed, much less can we talk about the foreign assistance that will be necessary for the numerous industries we propose to start in the Third Plan period.

If the U. K. joins the Common Market, the "Inner Six" as they are called, the sixes become Sevens and as regards the "Other Seven", they will become six. We will be at sixes and sevens as far as they are concerned. The U.K. has been accounting for nearly 27 per cent of our exports and the European Common Market countries for nearly 8 per cent. Both combined account for 35% of our exports. Likewise, in imports the U.K. accounts for 20% and the Common Market countries, which accounted for only 8 per cent formerly, now account for up to 18%. These imports are mainly of goods which we badly want for development purposes. Another aspect we have to remember is that some of these countries are also members of the Aid-India Consortium which has undertaken to provide the necessary foreign exchange for us. This is particularly the case with West Germany. These countries have to see that the existing pattern of trade is not disturbed very much. It is not charity that operates on the international sphere, it is only enlightened self-interest which governs the countries in making their choice of one policy or the other. There is, therefore, no question of charity or begging. What we really ask them to consider is this! They have been exporting goods to us. We have been importing capital goods and machinery and raw materials for building our industries. It would be entirely in their interests to see that they do not also bring down our exports to them. They want to be paid back and would like to be paid back only in terms of trade, which is the most honourable way of doing it. Therefore, unless they want us to turn to other countries, which I am sure will not be in their interest, politically and otherwise, they should continue to so evolve the Common Market pattern and their tariffs that India continues to enjoy at least the existing *status quo* if not any other privileges. This will be desirable both from the point of view of enlightened self-interest of India as well as of the Common Market countries themselves. There is, therefore, no question of favours from them. If they want to send their capital goods and machinery, which they are certainly very anxious to send, they have also to provide for some additional markets for our exports.

The Union Ministry of Commerce and Industry has analysed some of the facts and believes that India is likely to lose about one-fifth of her trade with the U. K. Our overall trade with the U. K. is of the order of Rs. 200 crores and that would mean our losing about Rs. 40 crores of trade. It is not much from that point of view. We have to build up markets elsewhere. Tea is one of our major exports to the U. K. accounting for nearly Rs. 85 crores of foreign exchange. In this regard also, it has been worked out that there will be only a marginal difference as far as exports are concerned, though certainly for the average Britisher, it will have to pay something higher for his cup of tea because to the extent of the tariff the price of tea will go up. But that is a situation of their own creation and they cannot blame us for it. Jute, which accounts for nearly 21% of our exports, is not likely to be very seriously affected. Dundee jute is already protected and the only rival we have is Pakistan and there is not going to be a material difference from this point of view. The only export item which comes into trouble is textiles. It is estimated that nearly 50% of our exports of textiles is likely to be affected. The export earning of Rs. 19 croros might come down to Rs. 10 crores. This is obvious because India today enjoys a preference of 17½%over the Common Market countries. By 1970 those countries will enjoy over us a preference to the extent of of 15%. That naturally cripples the competitive capacity of India.

The question is how far safeguards would be safely negotiated for us. I am not very sanguine about these safeguards. If safeguards are ever negotiated, that would be done on the basis of mutual interest. It is quite likely that in the context of the larger developmental problems with which we are concerned, the Common Market countries may agree to provide certain safeguards, liberalisation of quotas etc. If that comes about, it will be as a result of appreciation of common interests by both the groups.



The question of an Asian Common Market arises in this context. This idea has been mooted by quite a few. A sort of a vague suggestion is thrown out that if the European countries can organise themselves into a Common Market, why not the Asian countries? The idea of an Asian Common Market, on the lines of the European Common Market, is likely to be premature. We have all common problems of the same nature. What can be achieved with a certain measure of success is the possibility of a closer integration between these Asian and African countries. There can be a certain amount of integration among the raw material producing countries with a view to enabling them to negotiate in a better way with the advanced countries. But there is a snag. All these so-called backward countries are in a state of development. They will soon become, as we are ourselves trying to become, rapidly industrialised. In this context, we will have to use our own raw materials, barring a few items. The whole pattern is so rapidly changing that it is difficult to categorise countries as raw material producing and industrially advanced countries from that point of view. However, it appears that a certain amount of integration is possible and that might add to our bargaining power.

Then there is also a move about an Atlantic Common Market. The long and short of the matter is that India is very peculiarly placed today. We are in a very critical position and particularly because of our development programme. There is talk today of reaching the take-off stage. We are promised that at the end of the Third Plan. It appears to me to be a little far off and not by the end of the Third Plan. If it happens, it will be a miracle for the Planning Commission. In the midst of this critical position, we are faced with a serious crisis on the export front. Our exports are stagnant today. They have not moved up with all our talk of export promotion, giving incentives etc. We have before us a target for raising our exports by nearly 30 per cent. I am very very doubtful about it. In the midst of there circumstances, if we are faced with another challenge that we are likely to lose some of the established markets as a result of the U. K. joining the Common Market, certainly it is a challenge which is much more serious. If we are not up to the challenge and the Government, the people, the people, the trade and industry do not face this in a bold way, we might stagnate rather than forge ahead as we have thought today. Therefore, the challenge remains "Export or stagnate" and it will be better if we can devise a plan whereby our exports can show up. The reasons are obvious We have to look within. It is not that other countries can always help us in the sphere of export.

International trade will continue to flow for all time to come, whether India industrialises herself or not, and no country can be self-sufficient. Even U. S. A. and the U. K. have exports. All these countries have to enter into international trade. When we industrialise, we have to look to South-East Asia and to the Middle East as ous natural spheres for exports. But at the rate at which we are developing, the manner in which we are doing it, and the high-cost economy which we are building up, as a result of inflationary pressures in the economy, whethere we would be able to stand the competition in the international sphere is a question of great importance. If we are unable today to succeed in some of the foreign markets, the main snag is price. Our products, apart from their quality, are also high cost products. These high cost products are the result of inflationary pressures which have been generated in the economy. Unless we look into this problem with all earnestness, we shall be failing in our efforts to meet the challenge posed by the proposed entry of Great Britain into European Common Market.

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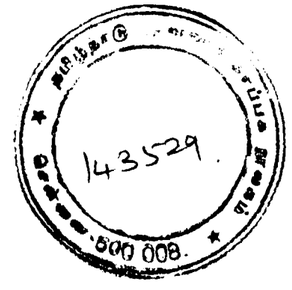

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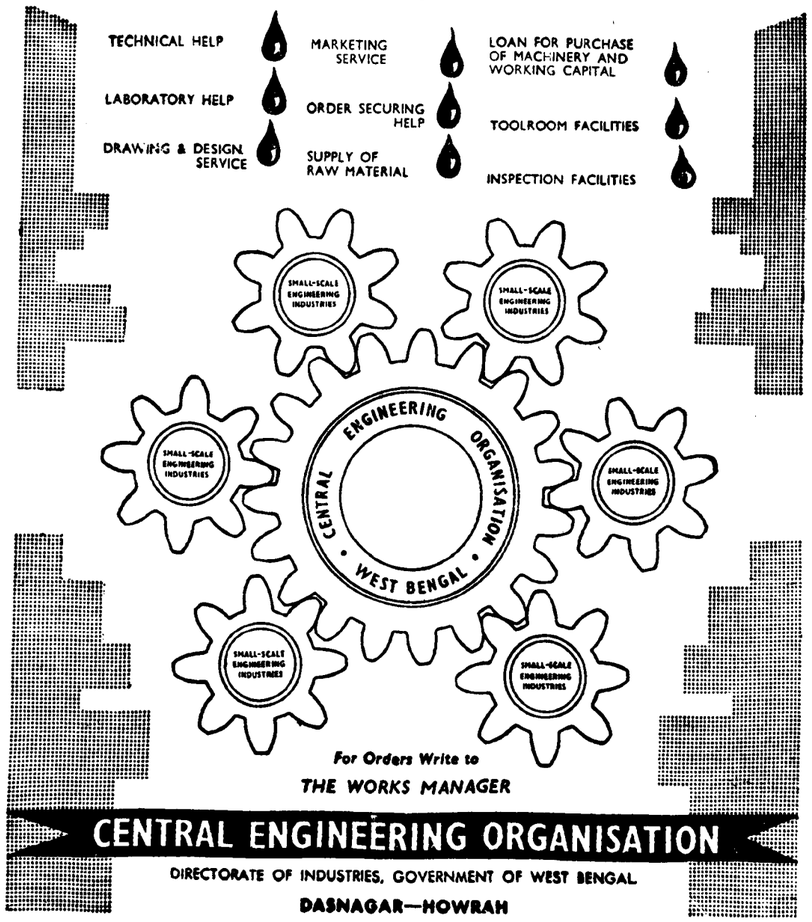


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# Plastics in Packaging

**C. I. ALMULLA**

Polychem Limited, Bombay

**Introduction**

Packaging industry plays a major role in any industrial economy; and the art and technology of packaging today has reached a high standard of specialization and perfection. There are various types of materials used for packaging, viz. paper boards, metals, laminates, plastics, glass textiles.

**Plastics in packaging**

The use of plastics in packaging industry has made great strides in recent years and in many cases has completely ousted other conventional materials such as metal, glass, wood, paper, etc. This will be evident from Table I and II. The references are made to the current positions in USA because of its tremendous advancements in this field compared to any other country in the world. Table III shows the current annual consumption of packaging materials in USA. The consumption in our country is much smaller and as such it would be worthwhile to study the pattern in USA that country being on the forefront.

Some of the distinct advantages of plastics over other conventional materials for packaging are as follows.

**Rigid Containers**

(a) Light weight; about 1/5 the weight of equivalent glass containers :

(b) Rigid Plastics containers can be sold at prices comparable to glass ;

(c) Sharper details and more uniformity can be had on plastics containers ;

(d) Can be produced in any colours at a little extra cost ;

(e) Safer than glass containers ;

(f) More design freedom ;

(g) Chemical inertness to most of the chemicals and materials ; and

(h) Non-toxicity.

**Flexible Packaging**

(a) Low moisture vapour premeability ;

(b) Non-toxicity ;

(c) Chemically inert nature ;

(d) Resistance to moulds and bacteria ;

(e) Resistance to abrasion, creasing, etc ;

(f) Durability under low temperature and deep freeze storage and tropical conditions ;

(g) Easy for sealing ; and

(h) Various types of equipment available for packing with full automation.

**Present Applications For Plastics Packaging**

*Thin Wall Containers :* Thin-wall containers are being used in great number for the packaging of ice-cream, delicatessen products such as cheese spreads, toffees, cookies, dry fruits. General Purpose Polystyrene where clarity is required or Rubber Modified Polystyrene where improved physical properties are required would have many advantages over the conventional glass or metal ones or paper boxes. Both polyethylene and rubber modified polystyrene lids could be used in capping these containers.

*Vials and Jars :* Polystyrene vials are ideal for packaging drugs, pills, pharmaceuticals etc and can be used in conjunction with polyethylene stopper corks.

*Compartmented Boxes :* A great number of hardware items can be packed in compartmented boxes. The boxes can be moulded in general purpose polystyrene. The advantages are low cost, clear attractive container and display of the merchandise without keeping it open. These could be used for assorted items using the compartments, viz. hardware, stationery, cookies, buttons, nails, etc.

*Closures :* The primary uses are in distilled spirits, detergents cosmetics and pharmaceutical vials and jars. These require a variety of materials primarily due to compositions which could attack some of the plastics. So it is necessary to test the closure in contact with the packaged item for stress-cracking before selecting the material. Materials being used commonly in this market are phenol formaldehyde, urea formaldehyde, polystyrene and linear polyethylene.

*Squeeze Bottles :* Introduction of blow-moulded squeeze bottle in polythylene has made possible a line of very attractive and colourful designs. The biggest application is the cosmetics markets for lotions, perfume sprays, after-shave lotions, creams, etc. They are attractive in design, light in weight and are safe to use.

*Collapsible Tubes :* All plastic collapsible tubes can be used for a range of products like shoe polishes, car cleaners, household detergents, cosmetics, creams, shampoos, pigments, dyestuffs, artists colours, lubricants, etc. The tubes can be made in PVC with a polyethylene or polystyrene closure cap.

*Plastics Laminates :* The strength of laminated films is often greater than the individual films forming the laminate. Thus cellophane laminated to polyethylene is ideal for packing frozen foods and juices. Polyethylene lined hessian-cloth bags are tough and moisture proof and are good for transportation. The advantages of plastics laminates are improved strength moisture resistance and security against pin holes of the films and the effect of creasing.

*Transparent Flexible Films :* The most common materials are cellophane, cellulose acetate, Pliofilm, PVC, Polystyrene, Polyethylene, Polyester, Polypropylene and Saran. These packaging wraps apart from protecting the product from dust add considerably to the sales-appeal by giving a chance to a customer to see what he is buying. The introduction of automatic packaging machine and the adaptability of most of these films to these machines has resulted in a substantial increase in the use of these films. This has also given scope to packaging viz, Skin-packaging, blister packaging, etc by employing vacuum forming techniques. The items that could be packed in films could be anything from fruits, vegetables, laundered clothes, etc to machine-parts, tools food concentrates, dehydrated foods, etc.

Polyester films are comparatively a new addition to the family of transparent flexible packaging materials. It is made from a condensation polymer of ethylene glycol and terphthalic acid. It has exceptionally high folding endurance and high heat resistance.

Polystyrene film has gained popularity as a versatile packaging material because of its properties like high tensile strength, very good clarity, low cost, excellent bursting strength, and very low moisture absorption.

Polypropylene films are more stiff and have better tensile strength as well as higher heat resistance compared to polyethylene and polystyrene. It has the lowest specific gravity of all the available thermoplastics and thus a high yield per pound.

**Health Safety Consideration**

A plastic container or any container for that matter, may come in prolonged and intimate contact with a packaged foodstuff, a drug or a cosmetic cream. Thus it is possible that some quantity of one or more of the components of the container may migrate into the food product or the contents of the package. The fabricator should be careful to use only those materials recommended as suitable for food and cosmetic or drug contact applications.



And in turn it is the responsibility of the raw material manufacturer to fulfil both moral and legal obligation for determining the suitability of his material from the public health standpoint for its use in contact with food, drugs and cosmetics. He can determine the safe level of an extractable component of a plastic food packaging material by toxicological study of the particular formulation. If neither the base resin nor the additional agents are extracted into food, there is no public health problem regardless of the toxicity of the specific materials.

**Conclusion**

Packaging industry in India is in a rudimentary state and there is a wide scope for development. We are getting industrialized rapidly and every effort is being made to increase the standard of living. With the continuous increase in our daily needs, rising standards of living, the consumer is getting descriminative about what he wants to buy. This calls for better designed attractive packages with an eye-appeal. And plastics will be the only answer to keep pace with the descriminative demands of a consumer.

@ TABLE I

**GROWTH OF FILM PACKAGING MARKET IN U.S.A.**

*(Clause 2.1)*

| Material | Production in million lb. in the year | | | |
|---|---|---|---|---|
| | 1958 | 1959 | 1960 | 1961 |
| Cellophane | 415 | 425 | 441 | 454 |
| Polyolefins** | 183 | 230 | 214 | 342 |
| Pliofilm | 19 | 23 | 25 | 27 |
| Vinyl | 10 | 12 | 15 | 17 |
| PVC | 14 | 15 | 17 | 19 |
| Mylar | 1 | 1 | 2 | 3 |
| Cellulose Acetate | 5 | 5 | 2 | 5 |
| Total ... | 647 | 711 | 779 | 867 |

*This does not include household wrap market (M.P. Jan. '61 p. 99)

**Includes HDPE, LDPE & Polypropylene.

@ Reproduced from Modern Plastics, Jan. 1961 p. 99.

TABLE II

**TRENDS FOR THE CONSUMPTION OF PLASTICS FOR PACKAGING IN U.S.A.**

*(Clause 2.1)*

| Material | Consumption, percent of the Total, in the year | |
|---|---|---|
| | 1959 | 1960 |
| (1) | (2) | (3) |
| Polystyrene | 16 | 18 |
| Polyethylene | 80 | 85 |
| Blow Moulded | 6 | 25 |

*Reproduced from Modern Plastics, Jan. 1961.

*TABLE III

**CURRENT CONSUMPTION OF PACKAGING MATERIALS IN U.S.A.**

*(Clause 2.1)*

| | No. of Containers |
|---|---|
| Glass Containers | 22 Billion |
| Closures for glass containers | 70 ,, |
| Metal Cans | 42 ,, |
| Paper boxes & containers | 140 ,, |

*Reproduced from Styron Symposium Volume.

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- To place a spare label inside
- To mark correctly
- To remove all traces of old markings
- To address neatly, boldly and indelibly
- To indicate the nature of goods consigned

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# The Visit to India of Mr. Paetzold

Dipl. Ing. Ernst Paetzold, member of the Deutsche Messe-und Ausstellungs-AG., and his colleague Mr. Rohereke have just returned to Germany after a successful goodwill tour of India and Ceylon where he showed a colour documentary film of the 'Hanover Fair' and also lectured to large gatherings of Industrialists and Businessmen of Bombay, New Delhi, Calcutta and Madras. After a successful career in Civil Service and later, on the executive board of the Central Association of the Electrical Industry, Frankfurt-on-Main., at 43, Dipl. Ing. Mr. Paetzold joined the board of Deutsche-Masse-Und Ausstellungs-AG., Hanover in 1953. He takes a prominent part in the development of the Hanover Fair and in promoting its International character, a matter which has come especially to the fore in recent years. On his frequent travels he has gained an intimate knowledge of the problems of International Trade, having visited most of Europe, The U.S.A., Canada, India, Iran and various African countries.

An export fair was established in 1947 to enliven foreign trade after the Second World War and give work to millions of unemployed. Nobody foresaw that this city would one day become the *venue of a world-wide fair*. Since suitable halls happened to be available in Hanover on a one-time Industrial estate scheduled for demolition, the main intention was to promote a much-needed economic development.

The formation of the Deutsche Messe-Und Ausstellungs-AG., in Hanover followed and this Company since 1947 have been the organisers of the annual fairs held there. Only German exporters exhibited in Hanover in the early years, but the Fair developed so quickly into an important International market that foreign exhibitors soon hurried to rent space and take advantage of the continuously increasing International demand. Thus the first forty-five foreign manufacturers were already represented at Hanover in 1950.

The Hanover Fair is now a *meeting place of International trade and Industrial experts* which none wishes to miss, not least buyers from all parts of the world. In the German and foreign Industrial groups represented they have a comprehensive display which offers the best opportunity for close comparison in each branch of Industry.

The area of covered halls available at Hanover in 1947 amounted to 322,900 sq. ft. In contrast, the Hanover Fair in 1961 required 3,358,000 sq. ft. of covered halls (1962: 3,789,00 sq. ft.)

The open air space rose from 86,000 sq. ft. in 1947 to 2,228,000 sq. ft. in 1961. During this period, the number of exhibiting manufacturers reached a total of 5,400 compared with 1,300 in the first year. Of these, over 1,100 are foreign firms. The number of visitors all over the world amounts to well over one million annually, of whom more than 10% are buyers from Europe and overseas. Mr. Paetzold stated here that nearly 100 countries were represented at the last fair with vast displays of their production along with representative collection of the products of German Industry. Thus he added, Hanover Fair is a unique medium for buyers of all nations and Continents to study the latest developments in various Industries and countries on the competitive basis of world production.

Mr. Paetzold while in Delhi requested the Govt. Of India to set up an Information Booth in the International Centre of the Hanover Fair where there are Information stands of over twenty European and Overseas countries. Here information on export matters relating to the countries is given. The countries of the Eastern bloc, Czechoslovakia, Poland and Soviet Russia are also represented.

The Prime Minister, Mr. Nehru, whom Mr. Paetzold met during his stay in Delhi agreed that the Hanover Fair was the best medium to foster and promote trade relations between India and West Germany. The Prime Minister also expressed that he is greatly in favour of India having an Information Booth in the Hanover Fair. The Commerce Ministry has now taken a positive decision and our Indian Embassy in Bonn has been intimated to give the final acceptance to the German Industries Fair authorities.

Mr. Paetzold in his talks to Industrialists and businessmen said that they should participate in the Fair and thus provide a glimpse of Industrial progress in the country to the business community abroad. The character and atmosphere of the Hanover Fair was beautifully portrayed in the colour documentary film that he showed to large gatherings in all major cities of India and thus conveyed their message in a much better way than any words of theirs could do.

# Life of Surgical Patient often Hangs on a Thread

After an operation a patient's life literally hangs by a thread.

These threads, or sutures as physicians call them, are used to close surgical wounds after operation. Because they can spell the difference between life and death, they must be produced with the utmost care and precision.

Each suture must be perfectly uniform. And since their diameters can run as small as 2/1,000 of an inch, for Purposes of eye surgery, an extremely rigid system of quality control is used to test each one.

The use of sutures is as old as surgery itself and extends back to the pre-Christian era. The Egyptians, more than 4,000 years ago reportedly used sutures in tying off blood vessels. Physicians in China and Japan, as well as the Aztecs of South America, all practised surgery and used sutures.

The primary suture materials in those days were linen threads, plant fibers, human hair, horsehair, silk and wire.

The Arabian surgeon, Rhazes, born in 865 A. D., is credited with being the first to stitch abdominal wounds with harp strings made from the intestines of animals.

Today, one of the world's largest manufacturers of sutures, Cyanamid International, maintains a plant in Australia to supply sutures from animal sources. Each month some 40,00,000 feet of sutures are sent to the United States for final processing, sterilization and packaging under the Davis & Geck trademark.

The animal-source sutures are the most widely used and are absorbed by the patient after a period of time into his own tissues. A second type of suture is not absorbed, but is encapsulated and remains permanently in the tissues of the body. This type includes surgical silk, nylon, cotton and stainless steel wire.

Modern manufacturing methods require careful testing and inspecting. At Cyanamid animal-source sutures are inspected for proper ply construction and gauged for correct diameter. In addition, they are tested for uniformity of absorption, tensile strength, knot security, flexibility and resistance to bacterial growth.

Knot security is extremely important; if a suture slips at the knot, complications in wound healing may develop. In the manufacture of surgical gut sutures, a special buffing technique is used to produce a soft matte finish which has superior knot-holding characteristics.

Recent Cyanamid innovations in sutures include permanently attached disposable needles and individual plastic packages. The first eliminates needle threading and greater patient safety in reducing the possibility of cross infection.

All these precaution are taken because in surgery a stitch in time saves lives.

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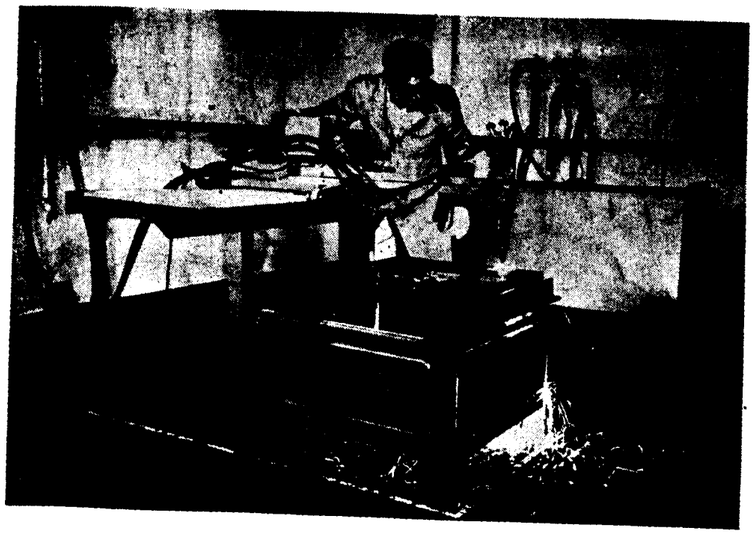
# Flame Profile Cutting Machine

Indian Oxygen Limited have pioneered the manufacture and development of many welding products and processes in India. As early as 1940, this company decided to manufacture manunl arc welding electrodes but owing to the intervention of the World War II, it was not possible to give shape to this decision till 1947 when they produced for the first time arc welding electrodes conforming to Lloyds and British standards in India. In the later years, they commenced manufacture of welding and cutting blowpipes, oxygen and acetylene regulators, medical anæsthetic apparatus, resulting in considerable savings of valuable foreign exchange.



In pursuance of this progressive policy, they towards the end of 1959, decided to manufacture locally a light machine—"CUB", which they were importing from one of their U.K. associates—The British Industrial Gases Ltd. This machine had proved extremely versatile and popular with the fabricators in India. This flame cutting machine is suitable for cutting profiles in mild steel up to a thickness of 76 mm (i.e. 3") and within an area of 787 mm × 660 mm (i.e. 31" × 26"). The machine can be fitted with a magnetic tracing head, which follows the contour of a steel template, permitting mass production of identical parts. To enable one-off parts to be produced, a hand guided tracing head to work around a wooden template is also available. This machine can also be fitted with a circle cutting and an automatic straightline cutting attachments. It is also possible to make 0—45° bevel cuts with this machine along its longitudinal axis.

The machine has more than 250 parts including various electrical components. As a result of experience gained by the technical personnel of this company in handling the imported machines, it was necessary to re-design the cutting blowpipe and its mountings, which are of Indian design, to suit local conditions. The first prototype was produced in a short space of time and was subjected to prolonged field trials before commencing full scale manufacture in the middle of 1960. A number of these locally produced cutting machines are already being used by the engineering works and one was on show at the company's stall at the Indian Industries Fair. This machine largely consists of parts manufactured in India excepting only ten items which have to be imported because of non-availability in the country.

This company has ambitious plans. It is hoped that they will be able to satisfy fully the demands for this type of flame cutting machine of the country.

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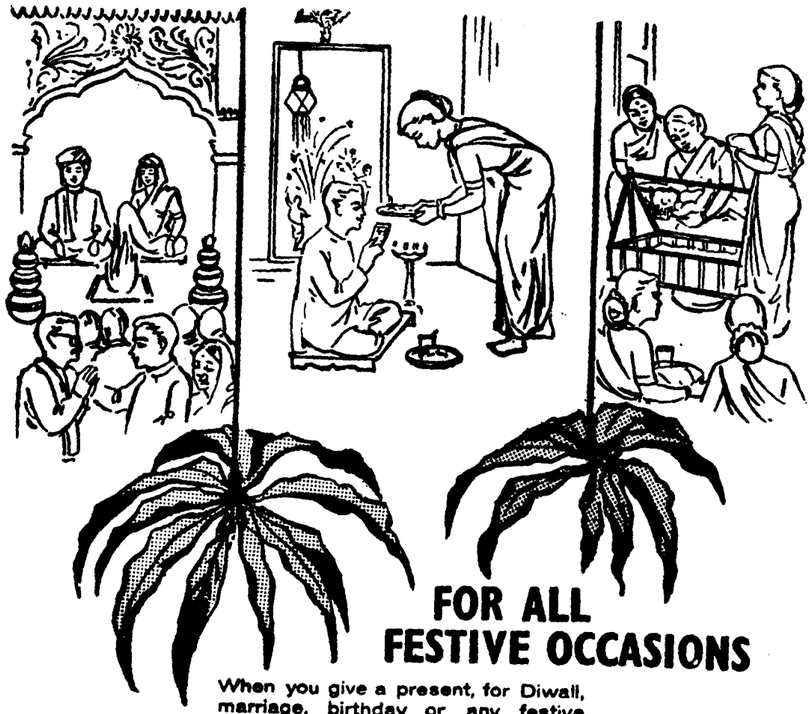

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# Factory Manager arrives from Mansfield

Mr. Desmond M. Walker of the Mansfield Tire and Rubber Company, Ohio, U.S.A., collaborators of the Madras Rubber Factory Ltd., arrived in Madras on the 5th February 1962 accompanied by Mrs. Walker. Mr. and Mrs. Walker were received at the Meenambakkam Airport by Messrs. Mike Bayer, Bob Schiffer and H.F. Leppert, Mansfield's representatives who are already in India, and the Managers of the Madras Rubber Factory Ltd.

Mr. Walker has been the Factory Manager of Mansfield's Egyptian Tyre plant and is now come to Madras to take charge of the Madras Rubber Factory Tyre plant, as the Factory Manager.

# South India Viscose

The Factory of "South India Viscose" at Sirumugai near Coimbatore was solemnly inaugurated on the 20th January by the Hon. K. C. Reddy, Union Minister for Industries and Commerce at a ceremony, presided over by the Hon. Sri K. Kamaraj, Chief Minister of Madras State and at which H. E. The Italian Ambassador in India and other eminent political personalities were present.

The factory consists of numerous imposing buildings, in which is installed modern machinery, mainly of Italian make, capable of producing daily 10 tons of rayon and 10 tons of fiocco, which could be increased in the near future respectively to 20 & 30 tons daily, when the planned expansion of the plant is realised.

The factory has been constructed and is managed by "The South India Viscose Ltd.", an Indian Company, the result of an agreement between "Snia Viscosa" and a group of South Indian industrialists.

The paid-up capital of the Company is about 10 million dollars, of which 24.4% represents the "Snia Viscosa" both under the form of supply of machinery as well as in the form of technical assistance, which embraces a very large and varied field of work.

Representing Indian interests at the ceremony were the Managing Director Mr. R. Venkataswamy Naidu and all the other directors of South India Viscose. For Italian interests, besides all the Italian directors resident in this country, Dr. Paolo Marinotti and Dr. Jean Ricotti, Managing Director of "Snia Viscosa," representing Cav. del Lavoro Franco Marinotti, President of "Snia Viscosa", who was detained in Italy because of unavoidable engagements, graced the occasion with their presence.

During the ceremony which was performed in an atmosphere of extreme cordiality, various speeches were made, in which the speakers spotlighted the beneficial effects of economic collaboration between the two countries united by an old and solid bond of friendship.



# Industrial Uses of Sugar

In spite of the fact that it is the world's "sweetest" business, the suger industry faces an uncertain and possibly sour future because of mounting surpluses and high costs of production.

The answer, according to the experts, is twofold. On one hand, new markets for sugar, which do not depend on the food industry, will be important in reducing the expected 1970 world surplus of over 5 million tons. This figure is about 4 million tons in excess of present surpluses.

The other half of the answer is a reduction in the cost of producing sugar. This is most likely to come about through mechanization of cane harvesting and modernization of existing sugar mills.

Fortunately for sugar-producing countries in every part of the world, progress is being made on both fronts.

**Reduction of Cost**

Take cost reduction. In an interview with Arthur L. Luttropp, engineer and sugar specialist with Worthington Corporation (U. S. A.), it was learned that substantial savings can result from the use of steam turbines instead of old fashioned steam engines as a source of power for the grinding mechanisms which crush cane into pulp as part of the sugar milling process. The Worthington sugar expert said that steam turbine operating costs are 10 to 25 per cent lower than for steam engines of equal horsepower.

Additional savings can also come from the installation of turbines during extensive modernization programmes or in the construction of new mills. The initial cost of a turbine is about half of the cost of a steam engine.

**Increasing Automation**

Increasing automation of the sugar milling process will also reduce costs, Luttropp declared. A great deal of experimentation is presently under way which will permit a larger degree of automation.

Considerable progress is also being made in the area of utilization of sugar in fields not related to food. According to H. B. Hass, president of the Sugar Research Foundation, sugar and its by-products are being used to produce industrial solvents, plastics, plasticizers, fibres, building materials, detergents, paper, wax, antibiotics and vitamins, oil drilling additives and even high explosives.

There is even a new branch of science that has been set up to explore new uses of sugar. This is known as "sucrochemistry."

**Bagasse Has Many Uses**

At the present time, one of the largest uses of sugar in a non-food application is the use of bagasse, a sugar cane by-product, in the making of paper and board and building materials. Bagasse is the fibrous material which is left over after the cane has been crushed and the sugar "liquor" extracted. Millions of square feet of building board are produced from bagasse every year. It is widely used as a sound and heat insulating material.

The use of bagasse for paper manufacture began shortly after World War II and successful commercial production has been noted in Argentina, Brazil, Mexico, Peru, Cuba, South Africa, India and several other countries.

Bagasse is also used to lower sugar mill fuel costs. In many mills it is used as a fuel for producing steam for driving turbines and generating electricity.

Presently, a great deal of research is under way in the use of sugar products for household and industrial detergents. Sugar Research Foundation sources explain that conventional detergents are difficult to break down in municipal sewage plants—the bubbles just won't pop and their accumulation necessitates expensive special equipment. Use of sugar would allow chemical destruction of bubble concentration greatly reducing costs and insuring trouble-free operation.

Sugar Research Foundation president Hass has stated that sugar must receive "serious attention" as a posible fuel to replace coal, petroleum and natural gas when present resources of these fuels are exhausted.

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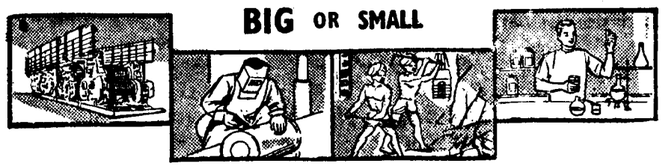

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# Indian Iron and Steel Industry

Sir JEHANGIR GHANDY, Kt., C.I.E.

Sir JEHANGIR GHANDY, Kt., C.I.E.

**India and the World**

India produced in 1959 just about 1.7 million tons of finished steel at a time when the total world production stood at about 240 million tons. If we add to domestic production the quantity of steel we brought from abroad, the total available for consumption was 2.5 million tons. This was barely 52% more than the corresponding 1929 figure of 1.65 million tons, compared with an increase of 165% in world output over the same period. Disheartening as this comparison is, I think we should note, in fairness to ourselves, that our domestic production of steel has increased by nearly 400% in these 30 years. We have tended, however, to reduce imports as indigenous production has built up, with the result that the consumption of steel has not increased as much as one would expect. I should add here, however, that the restriction on steel imports in recent years was due to compelling foreign exchange difficulties. In fact, Mr. T. T. Krishnamachari had envisaged liberal imports to permit steel-using industries to expand production and add to their capacity. Mr. Krishnamachari's idea was to build up demand so that when the Second Plan target for steel was fully realised there should be no difficulty in disposing of the full output.

It is important to remember that there is a close correlation between steel consumption and national income. It is obviously a matter of considerable importance that the use of steel should rapidly expand to help us along our way to the long term economic goal of doubling the country's per capita income by 1975.

Although we have sunk today to a somewhat lowly position in the world of steel, there is strong evidence to suggest that the use of iron and steel originated in India. In fact, India's pre-eminence in iron and steel continued right up to the 18th century, when a series of discoveries in Europe transformed the ironsmith's esoteric craft into a large-scale industry organised on scientific lines. The total world production of steel in 1870 was no more than half-a-million tons, but in a matter of 20 years it rose to 12 million tons, and the 28 million mark was reached in 1900. While these far-reaching developments were taking place in Europe, time in India stood still. The increasing import of iron and steel hardware, made cheaply by modern methods, was leading to a rapid decline of the craft in India, thanks to the free-trade doctrine conveniently adopted by the British Government of the time. In fact, the Indian craft had virtually disappeared by 1900.

### Early Attempts

Attempts were, however, being made right through the 19th century to develop the industry on more modern lines. Notable among these were the pioneering ventures by Josiah Marshall Heath at Porto Novo and Beypur, both of which, however, closed down after a fitful existence of some 30 years. These ventures stimulated interest in the possibilities of this industry, and we find, as a result, several attempts were made to establish production at widely dispersed localities like Kumaon hills in Uttar Pradesh, Indore and Chanda in Madhya Pradesh and Birbhum in Bengal. But none of these efforts was even moderately successful.

The idea of using coke instead of charcoal for smelting iron ore would seem to have been adopted first at Kulti, where an iron works was established in 1874. Despite initial difficulties and changes in management, the Kulti works survived and proved itself a commercial success by 1899. This Kulti unit thus deserves a special place of honour in the history of the Indian industry, and we might incidentally note that pig iron was produced here, with only a few interruptions, right up to 1958.

Although the manufacture of pig iron was well established before annually, steel-making by modern methods had not been attempted. This statement should, perhaps, be qualified because steel-making furnaces had been set up at the Ishapore ordnance depot in 1892 and at the Jamalpur works of the East Indian Railway in 1898. In both cases, however, imported pig iron was the starting material, and, in any case, the scale of production was very small. More significant was the attempt to make steel from Indian pig iron at the Kulti works in 1905, but this experiment proved a failure, resulting in heavy losses. Notwithstanding these failures, there were a number of experts who strongly believed in the possibility of steel-making in India. Among these was General Mahon, an artillery officer, who issued a remarkable report in 1899 holding that future efforts in steel-making should be based on the coking coal of Jharia.

### The Epic Search

The Indian economy, which had been badly hit by two terrible famines between 1895 and 1900, had entered a phase of 'mild prosperity' at the beginning of the century. It was in this period that Jamsetji Tata set in motion a long and costly search for iron ore to ascertain the feasibility of starting iron and steel manufacture in India on a large scale. As D. R. Gadgil says: "the fact that there were many deposits of iron in India may have been known, but there was complete ignorance as to their extent, their commercial possibility and, sometimes, even of their location".

Jamsetji, whom Jawaharlal Nehru recently described as a 'one-man planning commission', firmly believed that steel, power and scientific education were the three pre-requisites for country's economic advance. Although he did not live to see his dream come true, it was because of perseverance and steadfast effort that the epic search he instituted ultimately brought to light India's fabulously rich iron ore reserves and firmly established the country's tremendous potential in iron and steel. A tribute must also be paid here to P. N. Bose, a Bengali geologist, who directed the attention of the Tata prospectors to the deposits of Dhalli-Rajhara range in Madhya Pradesh, on which the Bhilai plant is based, and, later, to the hills of Mayurbhanj. Thus, India's first steel plant came to be established at Sakchi, a sleepy village on the main Calcutta-Bombay line, 45 miles away from the ore deposits of Gorumahisani in Mayurbhanj, 100 miles from the coalfields of Jharia and 150 miles from the important market and port of Calcutta. Once the technical difficulties had been resolved, the next major problem was to find sufficient finance. In this, the sponsors were greatly helped by the spirit of Swadeshi then sweeping through the country in the wake of the partition of Bengal.

### War and Expansion

The Jamshedpur steel works went into operation by stages in 1911-12. From the start, pig iron production was commercially successful and exports commenced to markets as distant as Western United States. Although steel production was soon running at the full rated capacity under the sitmulus of of military demand during the 1914-18 war, the sponsors realised that the initial scale of operations would have to be enlarged, if the plant were to become an economically viable unit. Planning for expansion, therefore, commenced in 1915, only three years after the first steel had been rolled, with the aim of raising capactity to 4,00,000 tons. Orders for new plant equipment were quickly placed but delivery was greatly delayed, first, because of war-time shortages and, secondly, because of a post-war boom in America which resulted in a frightful scramble for capital goods. This expansion, known in Tata history as the 'greater extensions', could not, therefore, be completed till 1924, but, in the mean time, a world wide slump had set in in 1921. Curiously, the





outlook just before the slump had been one of great promise. A new unit, Indian Iron and Steel Company, had come into operation in 1919, near Asansol, to make pig iron, and, later, steel. Sir M. Visvesvaraya had as Dewan of Mysore initiated a scheme for setting up a charcoalbased blast furnace, construction of which began in 1918. There were at least three other schemes in hand to start new steel works in the country. Belying these hopes, a very grim and trying period in the history of the Indian steel industry started in 1921-22. In the following years, imports were coming in at prices which clearly did not cover full costs. It was what economists called 'dumping'. Added to this, the continental currencies were fast depreciating, giving exports of these countries a tremendous advantage in the Indian market. In this desperate situation, Tata Steel informed Government in October 1922, that it would be forced to close down the manufacture of steel unless urgent measures were adopted to extend it some protection against unfair foreign competition.

Fortunately for the industry, Government had, under the pressure of Indian public opinion, so ably voiced in the Central Legislative Assembly by Pandit Motilal Nehru, just accepted a policy of discriminating protection. Opinion in India was as nearly unanimous as possible that steel was one of the industries deserving to be fostered and safeguarded in the larger national interest. Consequently, the claim to protection were admitted, and duties imposed to cover the gap between a fair selling price for Indian steel, as defined by the Tariff Board, and the low-priced imports.

I shall not go here in to the history of protection, interesting as that is, except to say that every time the question came up for review before the Tariff Board, the industry was able to show a steady decrease in production costs as efficiency improved and the volume of production expanded. By 1934, the Indian steel industry was meeting 75% of the country's demand as against only 30% in 1927. Even in the difficult depression years, substantial additions to plant and equipment had been made to raise finished steel capacity from 400,000 tons in 1926 to 600,000 tons in 1934. Protection had, therefore, been amply justified, because the industry had not only survived, but also demonstrably increased its competitive strength, although it was still unable to do without some slight "proteceion which was granted for seven years from 1934.

### The Clouds Lift

The rearmament boom got under way in 1936 with a consequent improvement in the fortunes of the steel industry throughout the world. In India, the outlook seemed bright enough to warrant an expansion of the industry. In 1936, steel-making facilities were added at Bhadravati in Mysore, where a small charcoal blast furnace had been in operation since 1923 based on raw materials of the area. In the same year, Indian Iron and Steel took over the Bengal Iron Company, which was operating the Kulti blast furnaces, to provide an adequate supply of pig iron to an independent steel-making unit, the Steel Corporation of Bengal. The Company was incorporated in 1937 with Indian Iron as its principal shareholder. We might note here that Tata Steel was also thinking in terms of further expansion and diversification, and had negotiated with other interests, namely Indian Iron and Steel, and Bird and Company jointly to sponsor additional capacity, particularly in strips and sheets. The proposal did not materialise, and Tatas decided, therefore, to go it alone.

Thus, at the start of the Second World War, the Indian steel industry was well set on the way to achieving viability. There were two major producers and one small unit. Output of pig iron had increased to 1.7 million tons, while the production of steel ingots reached the million ton mark. Notwithstanding the increase in home consumption, exports of pig iron were not only maintained but also expanded, averaging 551,000 tons annually in the five years ended 1939, while imports of all types of iron and steel goods declined from 1.2 million tons in 1929 to about 280,000 tons in 1939. Although Indian steel production had rapidly increased, it could not as yet meet the whole of India's normal needs.

### Second World War

Normal development came to a halt when the war broke out in 1939, necessitating shelving of the Tata expansion which included a scheme to manufacture tubes. Fortunately, the Scob plant, which was on order in Germany, had already arrived before the war commenced in September, and the plant was able to start production in November with a rated capacity of 2,20,000 tons.

Noteworthy among war-time development was the diversification put through under the pressure of military necessity. A wheel, tyre and axle plant was added at Jamshedpur in 1941. Since British specifications, followed rigidly in India, required acid steel for these items, a separate steel-making shop had to be set up, where steel was made by the cumbersome

triplex process. Also noteworthy was the manufacture of over 110 varieties of special steels at Jamshedpur for war purposes. Towards the end of the war, the Jamshedpur steel works commenced manufacture of electrical steel sheets of dynamo grade. This development helped powerfully in establishing the indigenous manufacture of electric fans and motors.

Taking 1937 as 100, steel production in India increased from year to year, reaching 142.9 in 1945. The production of finished steel averaged just over a million tons a year in the period 1940–45. During this period, exports of pig iron steadily declined.

### Estimating Future Need

Even while the war was in progress, the British rulers of the country would seem to have accepted the idea of planning to ensure the country's rapid economic advance. Among many planning agencies set up shortly after the war ended was one on steel, called the Iron and Steel (Major) Panel, of which I was a member. Our terms of reference required us to estimate future demand and recommend what steps should be taken to meet it from within the country. We estimated in 1948 that the demand in 1955 was likely to be of the order of 2.5 to 3.0 million tons. Taking India's current production in 1948 as 1.2 million tons and, adding to it, the tonnage expected from expansion at existing plants, we thought there would be a shortfall of a million to million-and-a-half tons. We recommended, therefore, setting up straightaway a half-million ton plant at a location called Tilda, very close to where the present Bhilai plant stands. We added that should demand grow at the rate we thought likely, action should be initiated a little later on a second half-million plant, to take India's total finished steel capacity to just under 3 million tons. We assumed, of course, that both the new plants would be laid out for an eventual capacity of a million tons each.

After our Panel had turned in its report, we were delighted to find prompt action taken on it in Delhi. Two firms of consultants were appointed in 1948 to prepare preliminary project reports. Both consultants generally endorsed the Panel's recommendations, and the stage was thus set for some concrete action, but the scheme was shelved on account of financial difficulties. The private sector schemes for expansion could not be proceeded with either, because the producers' plea for a revision of retention prices to enable them to set apart reasonable sums to reserves was turned down by the Tariff Commission.



### The First Plan

We have now reached a major landmark in India's economic history—the commencement of planned development. Formally, the First Plan started in April 1951, although, as you will remember, it was in many sectors nothing more than a consolidated picture of the developments already under way. Into the programme of industrial development for the five years 1951–56 was incorporated Tata Steel's modernisation and expansion programme to take ingot capacity from a million tons to 1.3 million tons. Similarly, in the case of Burnpur, a project was already under way to raise capacity from about 300,000 tons of ignots to half-a-million tons a year. Mysore had in hand an expansion to instal electric pig iron furnaces. They were hopeful also of establishing an electric duplex plant and a billet and light structural mill, but the resources available proved insufficient.

The Planning Commission was, however, emphatic that the main difficulty before the industry was that of finance. Partly as a result of this recognition, Government agreed during the First Plan to extend financial assistance to the industry by granting interest-free advances from the Price Equalisation Fund, Rs. 10 crores each to Tata and Indian Iron. This was in addition to a loan of Rs. 7.9 crores which Indian Iron had received before the commencement of the Plan to finance the expansion initiated in 1950, which I just mentioned.

The Planning Commission estimated that demand by 1957 would be 2.8 million tons of finished steel. This meant an uncovered gap of nearly a million-and-a-half tons, after taking into account the current expansion programmes in the private sector. The Commission was unable, however, to recommend anything more than a new half-million ton unit, because the resources were just not available. Work on these First Plan schemes really got under way in 1953, when the decision regarding advances to the private sector was finalised. In that year, Government also approved a further expansion by Indian Iron to raise capacity to 700,000 tons of finished steel and 400,000 tons of surplus pig iron for the foundries. The first steps regarding the new half-million ton plant were also taken in 1953, when an agreement was signed with the German combine of Krupp-Demag, shortly after which, Rourkela was chosen as the site for this plant.

This seems an appropriate point to summarise briefly the industry's developments during the First Plan period. Finished steel production by the three main producers increased only marginally from



1.07 million tons in 1951 to 1.26 million tons in 1955. The increase came mainly from the Indian Iron plant at Burnpur, where the 1950 extensions were completed in 1954. The Plan recorded, however, a significant rise in steel consumption with the volume of imports rising sharply from 178,000 tons in 1951 to over 900,000 tons in 1955, pointing to the quickening pace of industrial development.

### Four Fold Expansion

We now come to the period of the Second Plan—the most eventful so far in the history of Indian steel. The bold decision to raise capacity at one jump from 1.5 million ingot tons to 6 million ingot tons owed much to the vision and determination of Mr. T. T. Krishnamachari. It was he who initiated in 1954 a fresh survey to assess the future demand for steel following a proposal from the Soviet Union to assist India in setting up a steel plant. This survey showed that demand would rise to 4.5 million tons of finished steel, i.e. 6 million ingot tons, by 1961. A series of quick decisions followed. In March 1955, the Soviet proposal was accepted in principle, and Bhilai chosen as the location. The very next month, Government invited a British mission to examine the feasibility of a third steel plant. A few weeks later, the Planning Commission held meetings with the main producers and the Ministries concerned, where the proposals from Tata Steel to raise capacity to two million ingot tons, and from Indian Iron to set their target at one million tons, were discussed and shortly afterwards approved by Government. As a result of the re-thinking on future steel needs, a supplementary agreement was signed with Krupp-Demag in July 1955, to make the Rourkela plant a million-ton unit from the start. By the end of the year, preliminary discussions on the third plant had taken place, and the decision taken to locate it at Durgapur.

In the private sector, Tata Steel dovetailed the two million ton target into the expansion already in progress, to raise capacity to 1.3 million tons. The principal items of expansion were a new coke-oven battery and bye-products plant, a 1,650-ton blast furnace, the largest in India, an ore preparation and sinter plant, a new steel melting shop with seven open hearth furnaces, three converters to make steel by the blown-metal-scrap process, one blooming mill, two other rolling mills and extensions to ancillary facilities for water, steam, power and raw materials. The Tata expansion which was practically completed by March 1959, cost, including expenditure on ore mines, collieries and other ancillaries, Rs. 95 crores.

The Indian Iron and Steel Company similarly enlarged its scheme of 1953 extensions, chiefly to provide additional finishing capacity. Originally, Indian Iron were to produce 400,000 tons of 'free' pig iron for sale, and 700,000 tons of finished steel. Since three new plants were now being set up, it was thought that 650,000 tons of pig iron should come from Bhilai and Durgapur, and Burnpur should be permitted to produce 800,000 tons of steel. The 1953 scheme called for the installation of two new 78-oven coke batteries, two new blast furnaces, adding a converter and four open-hearth furnaces in the steel melting shop, along with a large volume of ancillary work. The 1955 revision entailed adding a bar and rod mill (Commissioned in June 1960) and additions to the sheet, bar and billet mill. The cost of this expansion was quoted as Rs. 50 crores in the original estimates. All major items of the 1953 scheme have been completed, while the 1955 additions are expected to be finished by about the middle of 1960.

### New Plants

All the three new steel plants have three blast furnaces each, with capacity ranging from1,000 tons a day at Rourkela to 1250 tons a day at Durgapur. Both Bhilai and Durgapur are making steel by the basic openhearth process and probably represent the last major steel works to employ this process exclusively. Rourkela, however, adopted the new L-D process for making three-quarters of its total steel output and the remainder by the basic open-hearth process. On the rolling side, Rourkela, which is specialising in flat products, has a blooming and slabbing mill, a heavy plate mill, a continuous 60" wide strip mill, cold reducing mills for sheets and a tinning line. Bhilai has, besides the blooming mill, a rail and structural mill, continuous billet mill and a light structural mill. Durgapur has, more or less, the same finishing equipment as Bhilai, except that it has a merchant mill and the very important wheel, tyre and axle plant which, together with the one at Jamshedpur, will make the country self-sufficient in these items.

At Bhilai, two coke-oven batteries, two blast furnaces, a part of the open-hearth steel melting shop, and the blooming and billet mills have been commissioned. The remaining two rolling mills, and several ancillary units, are likely to be completed by the end of 1960. At Rourkela, two coke-oven batteries, two blast furnaces, the L-D shop and a part of the open-hearth shop have already been commissioned, besides the blooming and slabbing mill. Still to be completed are the plate mill, the

continuous strip mill, and other finishing facilities like cold reducing mills and the tinning line. While good progress has been made in recent months, I am a little doubtful whether the remaining facilities will be ready for operation by April 1961, particulary the continuous strip mill. Durgapur, where work started last, has in operation two coke-oven batteries, one blast furnace, a part of the open-hearth shop and the blooming mill. Completion of the Durgapur project is set for mid-1961.

All the three new State steel plants commenced production during 1959, and contributed 770,000 tons of pig iron and 150,000 tons of steel, mainly semi-finished. Production at the two private sector units in 1959 represented an increase of 450,000 tons of steel and 500,000 tons of pig iron over the previous year. As Sardar Swaran Singh said the other day, the additional output represented a saving in foreign exchange of over Rs. 70 crores.

The commissioning of a plant is not the same thing as bringing it to full rated production. This will take, as is borne out by experience of steel plants all over the world, some two to three years. If everything goes well, we may expect the Second Plan target of 4.5 million tons to materialise in terms of production by the end of 1963. This is, of course, hoping for the best but, actually, it may take a year longer.

**Lessons for the Future**

Apart from the delay in getting to the goal we set for ourselves, there has been much criticism in Parliament and outside of the increase in cost estimates. In fairness to Hindustan Steel and the Ministry, it is necessary to remember that the contracts were finalised in great hurry in the last few months of 1955, after several years had been wasted in merely making up our minds. It was not possible, therefore, for costs to be worked out in detail at the time when the proposals were presented to Parliament. Secondly, after the detailed project reports were received, consultation in India revealed omissions or the need for certain adjustments, which have entailed extra expenditure. Thirdly, it is undeniable that, at the start of the Second Plan, official machinery for handling projects of this magnitude just did not exist, largely because a sufficient number of qualified people were not readily available. Finally, the speed with which the Second Plan programme was put through made it necessary both for Government and the private sector to rely somewhat heavily on foreign consultants and contractors. Indications, however, are that the appropriate lessons have been learnt. As Mr. G. Pande, Chairman of Hindustan Steel, said the other day, the objective for the Third Plan is to use indigenous resources for the planning, designing and manufacturing of machinery and equipment to the maximum possible extent. This will become increasingly practical as manufacture of heavy engineering items and electrical equipment develops in the country. Work has commenced in recent months on the heavy engineering, and the forge / foundry projects at Ranchi. Work was started earlier on the plant for heavy electricals at Bhopal. It is now learnt that two more similar projects drawing upon Soviet and Czech assistance are proposed to be included in the Third Plan. Again, negotiations for expansion of the three existing State plants have been commenced early, and a preliminary project report already obtained for the new plant to be set up at Bokaro.

**Outlook on Coal**

Let us now consider briefly some of the technological problems of steel production in India. This involves primarily an evaluation of the raw material base of the industry. While we have very large iron ore reserves, some 21,000 million tons of first grade iron ore—we have barely 2,000 million tons of coking coal. Considering that we need 1.5 tons of coking coal to make one ton of steel, the long-term outlook is grave indeed. Even in the short term, it is difficult to find enough coking coal to meet the requirements of the steel industry, and other essential users. As a result, the industry is being obliged to use poorer grades with high ash contents, leading to a number of serious difficulties—notably the curtailment of production from blast furnaces, and a rise in costs. Methods fortunately exist for upgrading poorer coals, the process calling for washing to remove inert matter and thus reduce ash. Although the process was well established, its application to Indian coals was gravely doubted until Tatas successfully set up two washeries and demonstrated the feasibility of washing. Other methods of upgrading coal exist, one of which has been tried out successfully in France and South Africa. Additionally, some very interesting pilot-scale operations have been conducted at the Fuel Research Institute at Dhanbad and at the Coal Blending and Coking Research laboratories at Jamshedpur. These offer promise of some relief, particularly in the direction of reducing coking coal requirements by blending with non-coking coal to the extent of 15 to 20%.

The shortage of coking coal has directed attention in many countries to the possibility of using an alternative fuel or bypassing the blast furnace altogether. The East Germans, who face a similar dearth of coking coal, have been producing pig iron using lignite as fuel. This is of great interest to India, because we have, in the South, large deposits of lignite which could support a steel industry in the area. The concrete steps that have been taken to pursue this possibility are the establishment of a pilot-scale low shaft furnace at Jamshedpur to assess the suitability of Indian lignite and non-coking coals for the manufacture of pig iron. This plant, which was inaugurated in January 1959, is engaged on a series of investigations, but it is as yet too early to forecast the outcome. Another step taken by the Madras Government was to invite a delegation from East Germany to examine this problem. The delegation is reported to have expressed the view that Indian lignite can be successfully employed as a fuel. Further tests are to be made for which 2000 tons of Indian lignite are being sent to East Germany for production tests in their plants.

**Limestone Shortage**

Another problem relating to raw materials is the shortage of good quality limestone, particularly necessary for use in the open-hearths. Supplies are by no means plentifully available in the vicinity of the steel plants, although the country as a whole has large reserves. At present, all the limestone for the steel plants is drawn from one area, the Sundergarh district of Orissa, except for Bhilai, which obtains supplies from a nearby quarry at Nandini. Reportedly, Durgapur is looking for an alternative source of supply in the Shahabad district of Bihar, but it will be some time before demand is actually diverted from Sundergarh. In the mean time, the scramble for good limestone is getting increasingly worse because, although the area can conceivably yield larger supplies, this depends on the availability of rail transportation from new quarries. Hence, the need to expedite railways construction in this area, particularly the projected Ranchi-Rourkela line which would help to exploit several new deposits. including the one at Purnapani, which is being developed for Rourkela.

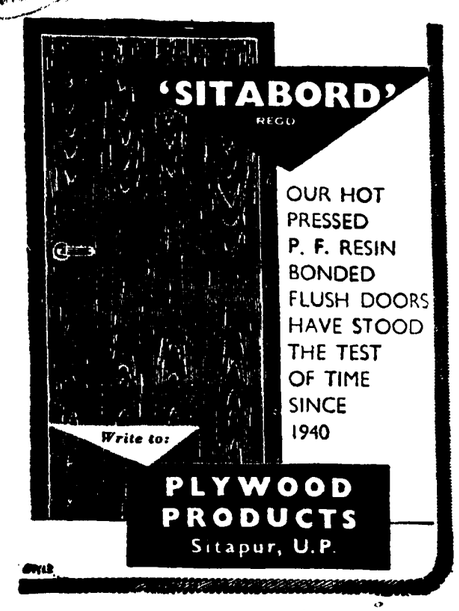
**New Processes**

I should like to call your attention to two innovations introduced during the Second Plan period. As I mentioned earlier, Rourkela is employing a new method of steel-making known as the L-D process, developed in Austria in 1949 and the first commercial plant started in 1952. I might mention here that Tata Steel was one of the first to send a technical mission to study this process. When this mission visited Austria in 1953, the process was chiefly employed for making low carbon steels, and was based on a quality of ore, as starting material, which was low in phosphorus unlike our Indian ore. It was at that stage considered unsuitable, therefore, for adoption at Jamshedpur. Later developments have greatly increased the versatility of the process. It therefore, became possible to adopt it at Rourkela particularly as this plant needed large quantitities of low-carbon steel for making flat products. It is noteworthy that both at Bhilai and Durgapur where high carbon steels were needed in bulk for rails and structurals the openhearth process was exclusively adopted. The L-D process is today particularly attractive because it makes possible large economies in capital cost and in operating expenditure. It is certainly the process that we would adopt at Jamshedpur, if we were permitted to put down additional steel-making capacity. The Second innovation is the use of ore-crushing and sintering to pre-treat iron ore before charging it to the blast furnaces. Ore as received at Jamshedpur from the mines varies widely in size from 1/8" to 4 or 5", which is not conducive to efficient blast furnace operations. With the new facilities we have installed, all incoming ore is crushed and sized. Fractions ranging from 1/2" to 2" size are sent direct to the furnaces while smaller fractions go to the sinter plant where they are processed with coke breeze, i.e., coke less than 3/8" size arising during coke-making, and flue dust, the residue collected from the outgoing gas from the blast furnaces. Sintering lightens the work of the blast furnace and improves its efficiency, besides permitting utilisation of materials like ore fines, coke breeze and flue dust. Thus, sintering may be looked to for economy in blast furnace operations, particularly in reducing the consumption of coke and fluxing material. The value of sintering in Indian conditions is now fully recognised, and suitable equipment is being installed at all the three State steel plants. Rourkela, where sintering was not originally envisaged, has also fallen in line.

Turning now to the future, I feel sure that the coming years will witness a steady increase in steel capacity, notwithstanding the grave difficulties we face in respect of coking coal and limestone today. This follows from the fundamental need of the Indian economy to attain increasing self-sufficiency in capital goods. The imbalance between our exports and the growing import needs is one of the most serious problems, reflecting itself in successive foreign exchange crisis. Since economic advance

implies an increasing demand for capital goods, we must endeavour to make as much within the country as possible. Otherwise, the lack of foreign exchange will hold up progress, since we can neither expect to go on living on international charity, nor is it advisable that we should keep on accumulating foreign debts. Hence, the decision to accord the highest priority to heavy engineering industries. Steel being the principal raw material for these industries, it clearly follows that the expansion of steel capacity will remain an essential task for several future Plans to come. In the Third Plan, it seems to have been decided to increase steel capacity to 9.3 million tons—3.3 million tons above the Second Plan level. This is to be accomplished by expanding Bhilai to 2.1 million tons, Rourkela to 1.8 million tons, and Durgapur to 1.6 million tons. These targets have been set to make full use of the surplus capacity of the existing blooming mills. Thus, these three State steel works will together have a capacity of 6.5 million tons by the end of the Third Plan. A new integrated unit is to be set up at Bokaro to yield half-a-million tons initially. Mysore is assumed to contribute 100,000 tons and small-scale electric furnaces another 200,000 tons. Taken with the capacity of three million tons already existing in the private sector, this adds up to 9.3 million tons. No expansion of the private sector plants is apparently envisaged, which is curious since both Tatas and Indian Iron had firmly indicated their desire to put down additional capacity.

My colleagues and I sincerely believe that the experience and the organisation the private sector in the steel industry has built up over the past 50 years can be put to still greater use in the country's service. I feel reasonably sure that the private sector will not be denied these opportunities, because, as the Prime Minister stated at his monthly Press Conference in March 1960, the approach should be pragmatic, the decision based on what can be done effectively and quickly in either the public or the private sector.



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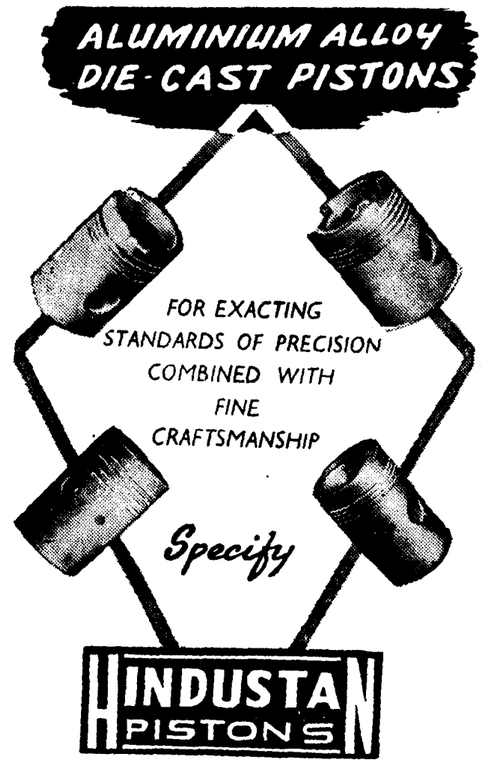


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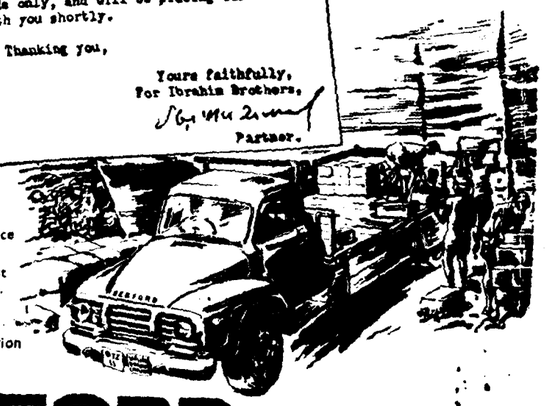

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