A GLIMPSE OF THE TATA IRON AND STEEL COMPANY LIMITED, JAMSHEDPUR

By D. P. Kharia*

Though the art of making iron and steel was known and practised in India since ancient times, and India's pre-eminence in iron and steel continued right up to the 18th century, the foundation of the commercial iron and steel industry in India was laid only with the establishment of The Tata Iron and Steel Company Limited (Tisco) at Jamshedpur in 1907 followed by The Indian Iron and Steel Company (Iisco), Burnpur, in 1937. Whilst elsewhere in the world far-reaching developments were taking place in iron and steel production, time in India stood still. The Indian craft had virtually disappeared by the beginning of the twentieth century.



It was given to Tisco's Founder, the late Jamsetji N. Tata, to revolutionise the Indian industrial conditions. He firmly believed that steel, power and scientific education were the three pre-requisites for a country's economic advance. It was his vision, perseverence and steadfast efforts which ultimately brought to light India's fabulously rich ore reserves and firmly established the country's tremendous potential in iron and steel. TISCO was conceived by Jamsetji Tata and its inception put India on the world's industrial map. The original plant was engineered and constructed with American know-how and assistance. Two 200- tonne blast furnaces, four 40tonne stationery open hearth furnaces, 180 Koppers non-recovery coke ovens, a steam driven 40" blooming mill, a 28" rail and structural mill and a few ancillaries were installed to produce 35,000 tonnes of pig iron and 50,000 tonnes of saleable steel a year. The first stake was driven in the site on February 27, 1908, plant construction commenced in autumn that year; pig iron was first made on December 2, 1911 and the

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first ingot was rolled on February 16, 1912. The plant attained capacity production by 1916 and thus dawned the current steel age in India.

Greater Extension Programme

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In 1914 came World War I and very heavy demands were made on Indian steel, particularly to meet the requirements of the East and Middle East theatres of war. With peace came the Greater Extension Programme, adding two more blast furnaces, the second steel melting shop (SMS No. 2), using the Duplex process, with acid bessemer converters and basic tilting open hearth furnaces and raising the capacity to half a million tonnes of finished steel per year. Subsequently, a new rolling mill complex consisting of a sheet, bar and billet mill, a merchant mill and a sheet mill was added, raising the capacity of the plant to about 0.9 million tonnes per year by 1940.

In the early years of the Second World War, an attempt was made to produce steel by the Perrin process, for which a third steel melting shop (SMS No. 3) was added. This shop, however, was modified for acid steel making to feed the wheel, tyre and axle plant (WT&AP) which was set up in 1941. Again, in the fifties, TISCO launched a Modernisation and Expansion Programme (MEP) to meet the war-time back log in repairs and renewals and to diversify somewhat production facilities. These measures raised the production to about 1.3 million tonnes for which steel melting shop No. 3 was replaced by acid bessemer converters and large stationary open hearth furnaces, operating on the scrap-hot metal-blown metal process. To cater to the demand for tube making, a new narrow strip mill was added and improvements made to the other mills.

Two-Million-Tonne Programme

With Independence, the era of planned development commenced and so into the first Five-Year Plan(started in 1951), TISCO's MEP was incorporated. In the latter part of 1955, TISCO decided to raise the capacity further to 2 million tonnes of ingot steel per annum, in line with the policy of the Government of India to increase the country's steel capacity in the Second Five-Year Plan. Under this expansion programme, called the Two-Million-Tonne Programme (TMP), the mechanising of the iron mines, provision of a new battery of coke ovens, installation of a large, modern blast furnace (F furnace), addition of the first-ever sinter plant in India for preparation of burden material for the blast furnaces, enlarging of the capacity of SMS No. 3, a 46" high-lift blooming mill, continuous sheet bar and billet mill, a medium and light structural mill and a second continuous merchant mill were undertaken.

For nearly 50 years after its inception, Tata Steel was not only the largest steel producer in the country, but also the producer of the lowest cost steel and a technological leader. As it is today, TISCO, now the only private sector steel plant in the country, has a rated capacity for the production of 2 million tonnes of ingot steel per annum, using a 50 year-old plant and equipment, and original, presently outdated steel making technology, based on conventional, blast furnace-open hearth-ingot steel-rolling route. Yet, year after year, a 100% and higher average production has been maintained.

State of Steel Industry in India

Seized with the need for a large steel development programme and within a few years as the only means of providing a solid base for accelerated industrial growth and self-reliant economy, and realising the difficulties in raising the enormous investments that would be required for this capital intensive industry, the Government of India earmarked iron and steel for the public sector, under the Industrial Policy Resolution of 1948. Suiting action to pronouncement, the Government decided to establish three new integrated steel plants at Rourkela, Bhilai and Durgapur with West German, Soviet Union and British collaborations respectively. These new steel plants, together with the expanded TISCO and IISCO, were to provide a total of six million tonnes of ingot steel per annum by 1961. Today, these steel plants in the public sector have undergone progressive expansion and modernisation, raising their capacities, a new steel plant has been added at Bokaro, more are being installed at Salem, and Visakhapatnam and some more are being planned, thus keeping a modest pace with developments world-wide in steel making capabilities.

Despite all these efforts, India, one of the largest countries in the world, ranks only 16th in order of production, and 22nd in order of per capita consumption of steel which is 14 kg. Compared to over 800 kg. per capita in Japan, India, indeed, has a long, long way to go. Keeping the diverse problems of the country in view, the Planning Commission has estimated that the growth in capacity for steel making would touch the 20-million-tonne-per-annum mark at the end of the current decade. Some improvements in technology are envisaged and it is in this context that sharing of expertise with leading steel makers in the world would benefit the Indian counterparts.

Details of the Plant and Facilities Available today

Hot metal is made in Tisco in six blast furnaces, the latest, 'F' Blast Furnace, rated to produce 1,650 thm per day, with high top pressure operation, is already 23 years old, while the others are much older. The iron ore is supplied to these blast furnaces from the Steel Company's captive mines, while just over 50% of the coking coal requirements are obtained from the Steel Company's captive collieries. Similarly, a part of the fluxes comes from the Company's own quarries and the balance requirements of coking coal and fluxes are supplemented by purchases. A battery of 364 by-product recovery coke ovens can carbonise about 6,807 tonnes of coal into coke. Iron ore fines are sintered in a sinter plant, which comprises two continuous strand machines, rated for 3,000 t. of sinter per day. Tisco also has India's only Pelletising Plant which can make 0.8 mtpa of iron ore pellets.

Steel is made in three steel melting shops. At Steel Melting Shop No. 1, the oldest shop, where four 85-tonne stationary open-hearth furnaces operate, the straight openhearth process, using 50% scrap and 50% hot metal, is adopted. This shop is designed to produce 15,000 t. of steel per month. At Steel Melting Shop No. 2, hot metal is first blown in the 25-tonne acid bessemer converters, (two operating and one standby) and then refined in three 120-tonne tilting basic open-hearth furnaces. The Duplex process adopted here is obsolete and is attended with low yields and restrictions on



Another view of Tisco Works

steel quality. This shop can produce approximately 600,000 t. of steel per annum. At SMS No. 3, where initially acid bessemer converters were also used in a semi Duplex process, today steel is being made by the straight open-hearth process using scrap-hot metal charges in eight 200/220 tonnes stationary furnaces, equipped with oxygen lancing facilities. This shop produces about 1.2 million tonnes of steel per year. Two 6-tonne electric arc furnaces at SMS No. 1 were in use until very recently for producing special steels as required, but those furnaces have just been dismantled. Electric furnace steel is also made in a 5-tonne arc furnace in the electric steel foundry (beyond the need for castings) and in two-10/12-tonne furnaces at the Electric Furnace Shop at Adityapur.

The bulk of this steel is teemed in narrow end up 7.7 tonne ingot moulds, placed on bottom plates, carried over trains of ingot bogies. The requirements for WT&AP, however, are made by duo-decagonal, bottom poured ingot and hot topping is adopted, wherever necessary, to improve yields. The use of wide end up moulds and extensive bottom pouring has just been started in Tisco, particularly at SMS 1 and at Adityapur.



Eleven different mills process the steel into a wide range of products and this is one of the unique features of Tisco. The stripped ingots are rolled to the required sizes of blooms and slabs at either of the 40" Blooming Mill (old) or 46" Blooming Mill (new). Further rolling to thinner sections is done in the modernised 32" reversing two high roughing and six 24" two high continuous finishing stands in Sheet Bar and Billet Mill (SBBM) No. 1 and a newer similar rougher followed by a nine stand continuous finishing mill on S.B.B. Mill No. 2. Other mills include a rail and structural mill, consisting of a 35" two high reversing stands, 28" three high roughing and intermediate stands, and a 28" two high finishing stand, one semi continuous cross country type medium and light structural mill with eleven vertical and horizontal stands; two merchant mills, one semi continuous cross country mill with ten two high stands, and another fast mill with a roughing train of six horizontal stands, an intermediate train of four horizontal and one edging stand and a finishing train with two horizontal and two vertical stands; a sheet mill with five semi-mechanised hot rolling stands and cold rolling facilities; one 96" three high roughing and finishing plate mill; a skelp and strip mill and WT&AP. The Adityapur Complex has a single stand continuous casting plant, a 7000 tpa electroflux refining unit for blooms/billets and a ring rolling mill. The Agrico works, adjoining the main plant, produces agricultural implements, like picks, powrahs, shovels, etc.

A shops complex, consisting of a general foundry, a non-ferrous foundry and an electric steel foundry, an ingot mould foundry, two machine shops, structural shops, welding shop, loco & loco repair shop, electrical repair shop, mechanical maintenance shop and works general services, all situated within the periphery of the Works, as well as the huge Adityapur Maintenance Shop, across the Kharkai river, cater to the maintenance and service requirements of the entre plant. The Adityapur Maintenance Shop is also rather unique in so far as it is the only facility of its type in India capable of producing virtually all steel plant equipment, including cranes, coke oven machinery, ladles, slag pots, etc., which is captive to the steel plant.

Water supply comes from the Dimna Reservoir and Subarnarekha river while power is generated in the Company's own thermal power plants, as well as purchased from Damodar Valley Corporation and Bihar State Electricity Board. Besides coal and coke, other fuels used are blast furnace gas, coke oven gas, mixed gas, producer gas, tar which are all generated in the Works, supplemented by purchased LDO and LSHS. A fleet of captive locomotives move materials from railheads to plant consuming points and from producing departments/shipping stations to railway marshalling yards, using either railway rolling stock or own wagons.

Products Manufactured

The installed facilities in Tisco are capable of producing 1.9 million tonnes of hot metal, 2 million tonnes of ingot steel and 1.5 million tonnes of finished saleable steel products. Saleable steel includes 0.3 million tonnes of semis for sale; 0.1 million tonnes of heavy plates, 0.15 million tonnes of hot rolled galvanised sheets, 0.25 million tonnes of strips (a total of 0.5 million tonnes of flat products) and 0.22 million tonnes each of light and medium structurals, merchant products, rails and heavy structurals, and 0.03 million tonnes of wheels, tyres and axles (i.e. a total of 0.69 million tonnes of non-flat products).

From the early stages of operation, Tata Steel has laid stress on proper control of processes used in the plant, inspection, and quality control for products, in order to ensure that all materials despatched to the customers satisfy specific requirements. The Steel Company has also been quick to respond to the challenges of change in requirements, successfully developing new techniques, introducing new products, and innovating for improvements. The Research and Development Division covers all these activities. Bullet proof armour plates and other armament steels for war, special structural steels for Howrah Bridge, dynamo-grade sheets for electrical industry, micro-alloyed steels, wear-resistant steels, cold twisted reinforcing bars, special forged blanks and rolled rings, Tisco's Direct Reduction Process for making sponge iron in a rotary kiln, work on preheating and briquette blending of coal are some of the major achievements of this group towards evolving an "Indian Steel Technology".

Modernisation in Hand

Being the oldest steel plant of the country, most of the facilities installed in Tata Steel are over 50 years old and consist of many units of small capacities using obsolete processes. Even the additions made in the plant during the two million-tonne expansion programme are over 20 years old.

The operation of the plant at and above its rated capacity, however, has been possible since the Steel Company has been continuously renewing and replacing wornout equipment, strengthening the infrastructure and improving the raw materials through a series of Rolling Five-year Capital Expenditure Programmes.

Recognising that a mere replacement of equipment can no longer fulfil the requirements of the Company in its objective of producing quality steel economically, a Modernisation Programme has just been undertaken.

At present, Tata Steel has three steel melting shops, out of which two shops (No. 1 & 3) use the open-hearth process which is an energy intensive process and one shop (No. 2) uses the outdated Duplex process for steel making. Priority has, therefore, been given to the modernisation of steel making facilities. As one of the existing Blooming Mills is also very old, it was felt essential to incorporate continuous casting facilities in the present modernisation programme. This would also take care of the marginal increase in steel production due to modernisation.

The modernisation programme aims at setting up a new 1.1 million-tonne oxygen steel making plant, consisting of two 130 T. top blown converters with one 6 strand con-cast machine for 100/125 mm billets, which will enable the Company to shut down Steel Melting Shop No. 1 and Steel Melting Shop No.2. The Modernisation Programme will result in a marginal increase of about 14% over the existing production level of 1.524 million tonnes of steel products mainly as a result of better yield from oxygen steelmaking and the introduction of continuous casting. Facilities for Vacuum

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Arc Degassing and Refining and Bar Forging Plant are also proposed to be set up to upgrade the product mix. A tonnage oxygen plant, lime and dolomite calcining facility and a tar-dolo-block plant are being set up as new facilities for serving the oxygen steel making plant. The Modernisation Programme is likely to cost about Rs. 205 crores.

Raw Materials

For a steel plant, four things are most crucial: ore, coal, water and shipping outlet.

The fact that there were many deposits of iron ore in India was perhaps known; but there was complete ignorance as to their extent, their commercial possibility and, sometimes, even of their location. So, the epic search was to locate the iron ore; then coal, a confluence of rivers with almost perennial water supply, and a rail outlet. Thanks to the undaunted efforts of the Founder, his sons and lieutenants, the ore body was located by a geologist, the late P. N. Bose, in Gorumahisani, coking coal was available in the Jharia fields. Plentiful water at the confluence of Subarnarekha and Kharkai rivers, and a rail head at Kalimati station, with ore and coal nearly decided the location of the plant.

No less than 3.5 million tonnes of various raw materials are required to make 1 million tonnes of ingot steel in Tisco; i.e. 1.7 million tonnes of ion ore, 1. million tonnes of coking coal; 0.05 million tonnes of gas coal; 0.5 million tonnes of flux, limestone and dolomite. In addition to these principal raw materials, other requirements include manganese ore, chrome ore, magnesite, quartzite, etc; and a number of ferro-alloys, like ferro-manganese, ferro-chrome, ferro-vanadium, etc.

Today, Tata Steel's Raw Materials Division operates 14 mines to obtain raw materials other than coal. The entire requirement of crushed, sized, washed supplies of iron ore comes from Noamundi (the Steel Company's largest and highly mechanised open-cast mine, 129 km south-west of Jamshedpur), Joda East (another 28 km away) and Khondbond. Manganese ore is received from Joda West Group, Bamebari, Joribar and Malda. Most of the limestone requirements are obtained through a longterm contract with Bisra Stone Lime Company. A small percentage, however, is received from the Steel Company's mine at Hatibari, in Orissa State. The Panposh and Gomardih mines, also in Orissa State, meet the dolomite requirement. The Steel Company's mines at Belpahar and Sukinda in Orissa State and Almora in Uttar Pradesh supply the refractory ores.

Approximately, 51% of the requirement of coking coal comes from its own collieries in the Jharia and Bokaro Coal Fields and two washeries at Jamadoba (the first in this country) and at West Bokaro, within 200 km from the Works. Coal is mined mechanically and washed to reduce the ash content, and maintain its uniformity. The current developments at West Bokaro, when completed, will make the Steel Company self-sufficient in coking coal also.

Man-The Core of Tata Steel

Despite the phenomenal progress in technology, mechanisation and automation, man in the industry will reign supreme, being the life-giving element to all other factors or means of production. The success and prosperity of any industry depends on how well he performs on the job; how well educated and trained he is; how his skills and experience are continuously enriched; and how well satisfied, contented, motivated and involved he continues to remain.

Keenly conscious that the most significant contribution will come from the untapped potential of the people, the personnel and industrial relations policy of the Steel Company pioneered, since inception, several steps for promoting and strengthening sound human relations, genuinely understanding the needs and rights of the employees, providing adequate wages, good working conditions, job security, an effective machinery for timely nonitoring and speedy redressal of grievances, opportunity for job enrichment and job advancement, as well as a three-tier scheme for closely associating employees with management.

The Steel Company has many "firsts" in matters of progressive labour policy eight-hour day work from 1921: leave with pay, provident fund and accident compensation from 1920; profit-sharing schemes from 1933-34; collective bargaining and then closer association of employees with management in the working of the industry since 1956. These and other milestones of labour welfare were not merel ymanifestations of enlightened self-interest but, more importantly, sincere measures to discharge truly and well the employer's obligations and responsibilities. Once began thus, we have never looked back. Mutual trust between the management and the union has adequately manifested itself in the just completed 50 years of industrial harmony—a milestone in management-union relationship, not only in India, but all over the world. Our policies have always been a step or two ahead of the contemporary trend.

To ensure upgrading of skills and know-how to produce sophisticated steels, Tata Steel has what is perhaps the most comprehensive programme of technical training organised in this country. Engineers, metallurgists, operatives, technicians, artisans, employees with minimal basic qualifications, are given need-based, but thorough, courses of technical education, both practical and theoretical, at the Jamshedpur Technical Institute. The parallel organisation, Management Development Centre, conducts development programmes on modern management concepts, techniques and skills, essential for decision making, problem solving and in other ways improving work performances, providing the conditions in which the people can make the fullest use of their talents and abilities in their jobs. Trade training, testing and upgrading, on-the-job training, off-the job training, multi-skill preparation, there is no end to the milieu of programmes offered, not only to the Steel Company's employees, but also to personnel belonging to other associated companies and the community at large.

Contributing to Nation Building

Tata Steel believes that true wealth comes out of dedicated work, not only of the many thousands that it employs, but the millions, across the land. As the first step towards fulfilling this objective for nation-building, in Sakchi, the sleepy village of a few straggling huts, surrounded by a jungle, Tatas started a saga of adventure, simultaneous with the turning of the earth to build the Steel Plant, seventy three years ago. They carved out a thriving industrial city, Jamshedpur, with all modern amenities and comforts, where none existed before. Just as the world's foremsot steel men designed and erected the steel plant, the foremost welfare consultants, architects and town planners created the amenities and comforts in the city: roads, parks, gardens, recreation centres, homes, places of worship, medical and health services, schools, markets, municipal facilities, etc. The fruits of these services are enjoyed by nearly half a million people today, at an annual cost of Rs. 12 crores.

The Community Development and Social Welfare Programme of the Steel Company was the next step undertaken by the Company since 1958. It covers about two million people in and around the city and, actitvities concerning their health, education, recreation and socio-economic advancement. This programme has brought about significant changes in the attitude and outlook of the people and improved their standard of living. The cost is Rs. 4 million every year.

Besides recognising and duly discharging its duty to the community at Jamshedpur, the Steel Company has always been ready and participating in welfare and relief work all over the country. In keeping with this tradition, in recent years, Tata Steel has embarked on an extensive scheme of rural development, not in the immediate vicinity of the city, but deeper into the rural areas. This programme is not only aimed at material assistance for the immediate economic uplift of the villagers but, more importantly, measures for building up the people, by motivating and involving them in the programmes. The Five-Year Plan of the Tata Steel Rural Development Society (TSRDS) covers 150 villages with 12,000 households and some 75,000 people in an area of 1300 sq. kilometres. An estimated expenditure of Rs. 1.5 million is envisaged in agricultural crop extension, dairy, poultry, piggery, goat rearing, village and cottage industries, horticulture, forestry, drinking water wells, roads, medical aid, adult education, etc.

The Future

The present modernisation is one of the series of steps the Company would take in improving the technology to remain as one of the most efficient companies as far as production, productivity and economy are concerned.