PART- 1: ORGANIZED SECTOR

CHAPTER- II: STEEL MILLS
A number of foundries are present in different districts of West Bengal, India. The most predominant being Howrah, North 24 Parganas and South 24 Parganas districts where foundries of various types exist. These foundries may differ in their work processes, some may be fully mechanized, some others may be partly mechanized and in some of them the age-old practice of hard manual labour persist. Apart from that they also vary in the products they manufacture- ranging from carbon/alloy steel castings for railways, industrial application and municipalities to decorative castings meant for beautification of roads and parks. The study was performed in the following foundries:

A) BICF
B) TMC
C) BESCOL

A) BICF: Since 1959 with a humble beginning and then backed up by years of hard work, dedication, perseverance- BICF has emerged as a front runner in the field of iron castings, worldwide and has been able to imprint its firm foothold in both Indian and international markets through their superior quality of Grey Iron Castings.
The unit has got a state-of-the-art plant where the entire manufacturing process goes through stringent pre and post production quality control and in-process stage inspection through chemical and physical test labs as per customer’s strict technical specification and material composition. Their horizon of export extends to USA, UK and Middle East countries.

Description of the Products:

a) Sanitary and Municipal Castings:
Manhole frames, covers and grates; Extension rings; Fancy cover and grate; cast iron flanges as per ASTM.

b) Industrial Castings:
Parts of machinery; Valve, meter and surface boxes; Fire hydrants and hydrant caps; Siphons; Hydrant extension; Agricultural wheels; Table bases; Counter weights and ballast weights; Marketing tables; Pipe rolls (Hangers); chairs.

c) Flanges and pipe fittings:
Flanged fitting as per BS Std. Specification; Cast iron flanges as per ANSI/BS Std.; Carbon steel and forged flanges as per ANSI/BS Std.

d) Fancy and Decorative castings:
Garden benches; Lamp posts; Decorative railings; Tree grilles; Shop scrapers; Pipes (square and round); litter bins; wheel guard; Road side bollards; Railing posts.

Description of the Process:

PROCESS- I
1) Preparation of floor sand and facing sand.
2) Supply of sand to floor and core making.
3) Chill Test.
4) Mechanical Test of the Product.
5) Prof. Machining.
PROCESS- II
1) Arrangement of Pattern core box and Mould box.
2) Visual Inspection of Pattern/core box.
3) Preparation of Mould core.
4) Mould and core closing/clearing of Mould box.
5) Pouring molten metals from hand ladle manually.
6) Knock out of moulds and fettling.
7) In process inspection of casting after knock out.
8) Fettling.
10) Machining.
11) Load test/hydraulic testing.
12) Assemblies.
13) Painting.
14) Final inspection.
15) Packing and loading.
16) Dispatch.

PROCESS- III
1) Cupola patchwork.
2) Checking of cupola needed for charging.
3) Inspection of electrical and maintenance equipment supporting cupola including pollution control equipment.
4) Charging of cupola.
5) Drawing molten metal from cupola into ladle.
6) Dropping of cupola
7) (Intricate Machine).

Melting Facilities: They have 2 Cupola Furnaces each of 4-ton capacity. These furnaces are used in the manufacture of High Quality Iron and Low Alloy Iron Casting. The workers for this particular job enter into the furnace before start in the morning for
laming the bricks of the furnace with cement. For charging the cupola furnaces, bed is prepared at the base of the furnaces and to do this, the charging materials are carried by buckets till the furnace has got enough heat and pressure to be charged up. Afterwards, the materials are thrown from upwards. The rate between coal and iron impurities is maintained throughout the whole course of furnace operation. In the cupola furnace the raw materials are as follows: PIG IRON—IRON ORE—BLAST FURNACE.

Here slugs cannot be reused and are continuously eliminated outside the furnace through a hole. The molten metal (iron) is collected from another opening of the furnace. The temperature of the furnace remains at 1150 °C for 10-12 hours.

Moulding Process: In the moulding area the assembly consists of top part and bottom part. Through the cavity of these two parts molten iron is poured and then mould boxes are prepared. There are two cavities: 1) Runner- for pouring and 2) Riser- for filling.

More than 2 cavities may also be present in the assembly depending on the number of parts of assembly. Duration of casting depends on casting volume and its weight.

A large number of workers work in this section. They do the job manually with hand ladle. The weight of hand ladle filled with red-hot molten iron is almost 30 kg of which 5 kg is the weight of the ladle itself. Before core making the workers stir the upper part of the molten metal in the ladles with a long stick to remove the slags, which later are sold in the amount of 4-5 tons/day.

The advantage of the use of machines is that hardness of the mould box is greater than that prepared manually. As a result the boxes can be reused and also the productivity is more than that prepared manually.

Fettling Process: There are a number of swing grinders, flexible shaft grinders and bench grinders etc to finish the casting. In the grinding section the workers grind the products at
about 3-4 pieces per day to remove extra metal. Each product takes nearly 5 minutes of time to grind.

Quality Control: There is a very good chemical laboratory where they carry out all wet analysis of metal. There are universal Testing Machines, Hardness Tester to check up the BHN (Brinell Hardness Number) of the castings as well as compressive Load Test Machine. They have also in house facility of hydraulic pressure testing arrangement in the physical laboratory to test tensile strength.

Handling: Equipments like forklifts, cranes etc are present for handling sand, scrap, metal and castings.

Pattern Shop: There is a small pattern shop with general tools more for the maintenance of patterns.

Machine Shop: There is a modern machine shop with general-purpose machine tools for machining the castings as per customer’s specification and for maintenance purposes. The factory already made their presence felt in the Export of castings. They have been exporting about 400 mt castings to USA every month apart from 50 mt per month to UK.

B) TMC: Established in 1956 in the suburbs of Kolkata, it is one of the leading Mechanical Structural Engineering Companies in India. The unit has technical collaborations with renowned multinationals of Japan, USA, UK, Germany, Australia and Holland. Beside domestic markets, the unit has also established its credentials in overseas market like Europe, Middle East, Africa, South Asia and Far East. It is accredited with ISO-9001 Certification of Lloyds Register Quality Assurance for Heavy Engineering Products and ISO-9002 for Carbon/Alloy Steel Castings for railways and industrial application.
Description of the Products: CASNUB Bogies; high tensile buffer couplers with high capacity; Draft gear; Coupler components; Side buffers; pivots; plungers and castings.

Description of Workstation:

1) Storage section: The raw material such as sand, steel, oil, clay, iron oxide, bentonite, limestone, silica and wood flour are stored in this section after being brought from various regions. Tools and equipments are also stored here. Separate lockers are also here for keeping personal belongings of the workers.

2) Sand mixing section: Here different varieties of sand are mixed with oil, clay, flour, molasses, iron oxide etc in sand mixer.

3) Pattern, core box, moulding and closing section: The pattern forms the underneath of bogie frame and is a replica of castings. The core box is the inner hollow portion of castings. The moulds are the outer portions of castings. In this section, the above products are produced. Pneumatic Rammer has been provided for ramming during core box making. 2 processes are involved in core box preparation: a) Sodium silicate carbon dioxide process & b) Phenol formaldehyde alkaline resin process.

During moulding, Rizer- a liquid material given a cylindrical or elliptical shape is used. It is the last material to solidify and provides for extra material to fill the gap, if contraction occurs during cooling of the metal. Then after casting, closing is done.

4) Melting Section: Here metals- steel, iron oxide etc are melted for operations undertaken by factory. Two types of arc furnaces are there: direct and indirect. The molten material from furnace is held in a ladle of 7 tonnes capacity. Limestone is added for obtaining pure molten metal. The melting temp is about 1600-1700 °C.
5) Heat Treatment Section: Annealing and Quenching are done in this section. The treatments in this section increase the tempering of the materials, making it hard or soft according to requirement. For plain carbon steel, annealing is done for 4 hours at 920 °C and quenching is done for 1 hour at 1050 °C, to increase hardness; tempering is done at 550-600 °C.

6) Bogie Section: Here bogies are given the finishing touches and stored.

7) Coupler Section: Here couplers and drift gears are given the final touch and stored.

8) Dispatch Section: The output products of TMC Steel Foundry Division are packaged here for marketing and supply as per demand. The products are properly arranged for transportation to avoid transport hazards. It has a good record of supplying its customers with good quality materials and a proven track record of on time delivery.

9) Research and Development Section: Here various investigations are done to check the quality of raw materials, metal chemical analysis etc. Then after heat treatment, physical testing is done. There are various instruments to facilitate these tests. There are also radiographic testing facilities. There is a chemical laboratory and a physical laboratory to facilitate these tests. Well-trained staffs perform these tests and investigations. All these assure good quality products.

10) Training Section: TMC provides well-organized and up-to-date training facilities for each and every worker. To make running of factory successful, it has its own training department in view of making the worker fit for their own tasks. The Training Department is properly managed and all record of worker’s performances is kept properly and these records are periodically checked by the factory management.
They give proper attention to the welfare of the workers. The doctors within the factory premises give the first aid and medication whenever injuries occur. If case is serious then they refer the patient to the ESI Hospital. The medication and treatment cost of the worker is paid by the factory form the worker’s welfare fund.

C) BESCOL: Established almost 25 years back in the district of South 24-Parganas in the vicinity of Kolkata, the company has emerged from humble beginnings to pinnacle of success in recent years. It mostly manufactures railway products and is known for in time delivery and strict quality maintenance.

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