CHAPTER - 3

AN OVERVIEW OF THE BRASS PART INDUSTRY
IN
JAMNAGAR DISTRICT

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3.0 INTRODUCTION

The brass parts industry is primarily an intermediate industry supplying a wide variety of brass parts and components to almost all the engineering industries ranging from electrical/electronics industry to automobile industry. It’s phenomenal growth could also be ascribed to the growth and diversification of other engineering related sectors of the industry. The brass parts industry has a heavy concentration in Jamnagar.

Jamnagar is the famous of 'Chhoti Kashi', 'Paris of Saurashtra', 'Brass City' etc…. The origin of the kingdom of Nawanagar, former name for Jamnagar, can be traced back to the times of Jam Hala who crossed over from the north, entered Saurashtra and conquered the greater part of the territory held by the Jethwas of Ghumli and called it Halar. The formation of the district came about with the consolidation of Nawanagar, Dhroll, Dhrafa and Jodia Devani. At present there are 10 taluka in this district. The district head quarter is Jamnagar.  

Jamnagar district is situated between 21° 47’ and 22° 57’ north latitude and 68° 57’ and 70° 37’ west longitude in the peninsular region in the north-west of Gujarat known as Kathiawar in Saurashtra. The district is bounded on the north by the Gulf and Rann...
of Kutch, on the east by Rajkot district, on the south by Junagadh district and on the west by the Arabian Sea with an area of 14,125 sq.km. which form 7.21% of the total area of Gujarat state.\footnote{2}

From a few insignificant brass button making units in the cottage sector in the early 40’s, Jamnagar now has a vibrant full-fledged Rs.700 crore industry with almost 4,500 units engaged in manufacturing brass-parts, with a product range of as many as 10,000 items. This is besides the 3,500 home-based units, which support job and manufacturing units with some odd labour-intensive jobs. A staggering 1,50,000 people earn their daily bread here.\footnote{4}

### 3.1 HISTORY AND EVOLUTION OF BRASS PARTS INDUSTRY IN JAMNAGAR DISTRICT

The brass parts industries in Gujarat is mostly concentrated in an around Jamnagar district which caters to the requirement of around 70% of the machine brass component of the country and also in some quantity export to various countries. The brass parts industry in Jamnagar supplies to wide ranging industries such as electrical appliances, automobiles, bicycles, electronics, building hardware etc.

\textit{Dinesh Awasthi}(2002)\footnote{5} As per the account the brass parts industry in Jamnagar above 60 years old. It started around the late 1940s as a result of downfall of the brass button making units. The main cause
for its downfall was the lack automated machines. They were not able to meet the demand for the good qualities of buttons manufactured by them. This was not the only reason the development of nylon buttons in Japan brought down the demand by a huge margin. It because non feasible for the manufacturer to continues in the competitive world of buttons.

With minor changes in the available machinery the brass button manufacturer changed their production into brass parts components. Necessity is the mother of invention. Their led to the development of the brass machine manufacture in Jamnagar. Along with this the casting also developed in Jamnagar. They were able to do it in a very cost effective manner.

According to Dhaval Maheta(2002)\textsuperscript{6} The first hardware factory ‘SVI’ using brass as raw material was started by Mr.Madhavdas Ravji Ashar, a Kuttchi Bhatia, whose ancestors came from Jaisalmar district of Rajasthan. Before starting this unit, they were trading in brass utensils, locks and handles etc, as an agent of Stanley Company of U.K. during the mid 40s. Based on the catalogue of the Stanley Company, they started manufacturing hardware items, one by one. Brass scrap was purchased locally (scrap of old utensils). Button units were main competitors for raw material which was in short supply. The technology used was primitive and inefficient. After casting they
used to file the utensils manually to even the surface. There were no facilities for machining.

Facing technological problems Mr. Ashar’s started a small workshop with the help of some of his more innovative workers and fabricated a few machines for him. At this juncture a young man Mr. Jayantilal Keshavlal, whose elder brother Mr. Hargovindbhai was working in SVI (Mr. Ashar’s factory) showed interest in fabricating machines. Given his innovative mind, with the help of Mr. Ashar, he developed J&K machines. For machining utensils and other hardware. By 1952 about 5-6 brass hardware factories were started in Jamnagar (mostly by the ex-employees of Mr. Ashar). Most of the entrepreneurs in this phase came from Kansara community.

Almost at the same time (early 50’s, immediately after the general elections of 1952), 5-6 young enterprising people led by an artisan Mr. Hirjibhai Mistry (mechanic) started their brass screw manufacturing units. While factories started by Mr. Ratansingh Bhanji and Mr. Vishnubhai Sujanmal Khatar in 1952 are still running, the other three brass-screw factories started by Mr. Jathabhai Parmar, Mr. Purushothambhai Parmar and Mr. Dhirenbhai Mehta closed down in the mid-70s. However, the demand for casting of the brass increased due to entry of these firms. Responding to these needs Mr. Ghelabhai Kanhabhai started his casting units in 1955. He earlier
used to do some job work for a few oil mills, which were operating in Jamnagar. Mr. Bhagwanjibhai Mistry also entered the field soon by starting his casting unit. This was the beginning of ‘job work units’ in Jamnagar.

Responding to the technological needs of the industry a few mechanics, which used to undertake small repair jobs for oil mills and other units, started developing and fabricating machines. Between 1953 and 1955 Mr. Tribhuwanbhai, Mr. Jayantilal Keshavlal (mentioned earliest) and Mr. Bhagwanjibhai Mistry started developing prototypes and fabricating machineries which could be used for turning, drilling, threading and machining. They manufactured simple, easy to operate and maintain, cheap but good quality turning machines, known as THADAS, which are still very popular among brass-part and component manufacturers. The level of innovativeness could be seen by the fact that way back in 1960.

Mr. Mohanbhai, owner of Janta Engineering, developed the first automat for manufacturing nylon buttons and first variety of automat for manufacturing brass-parts in 1968. Mr. Maheshbhai who was a technical, in collaboration with Vekarias developed a machine for making pieces from sections in 1971-72. over a period of time, appropriate technological capabilities have been developed and internalized in Jamnagar – appropriate because the machines being
developed in Jamnagar are most ideal for the given factor proportion. According to the chairmen of Factory owners association, now there are about 15-20 local machinery manufacturers.

The year 1955 was a watershed year in the industry when mines and mineral trading corporation, Government of India, started issuing import licenses liberally to the manufacturers to import copper, zinc (brass is a combination of both in the ratio of 60:40 respectively) and crucibles (used for smelting). Another major landmark in the history of brass part industry in Jamnagar was the creation of first state sponsored industrial estate in Jamnagar viz, GIDC Phase-1 in the year 1969. Subsequently about 5-6 smaller private industrial estates also were set up in Jamnagar. In 1983 the Government of Gujarat through its Gujarat industrial development corporation, launched the creation of GIDC Phase-II. These public and private industrial estates gave a real boost to the brass parts industry in Jamnagar.

Dinesh Awasthi With growing number of brass based units, orders started poring in for small parts and components used in electric fittings and appliances in the early-60s. It gave a big boost to the industry. As a matter of fact, the period 1960 to 1970 could be termed as the golden period for the industry during which maximum diversification and growth took place. It also was a precursor to building up of technological capabilities in Jamnagar, required for
manufucturing high value precision parts and components used in electronics, telecom, spacecraft and computers.

L.D. Joshi [2006]^\textsuperscript{12} Between 1960 and 1970 bicycle industry grew by leaps and bounds in India. Most of the bicycle tube valves, spoke nipple and other brass fittings were also not available in India. Japan was the major exporter of bicycle brass-parts, sanitary fittings and automobile parts. Jamnagar responded to the emerging markets and a few bicycle tube valve units started operating during the early-1970s. Now there are about 35-40 factories manufacturing bicycle tube valve, spoke nipples and other sanitary fittings, capturing almost 97 per cent of the country’s market share as well as exports of the valves. It was followed by automobile parts and sanitary fittings earlier imported from Japan.

There was a dire need for improving quality of the product. Brass road(wires) casted using sand casting technology were of poor quality and for manufacturing high value precision from Jodhpur(Rajasthan) which had an extrusion plant using virgin metal. To bridge the gap, first extrusion plant ‘Rajalaxmi metals’ was started in 1981 in Jamnagar. It was the first plant to use brass scrap as input for extrusion of brass bars and sections. It took almost eight years before the second extrusion plant ‘Rajhans’ was established on similar lines in the city. Now there are 6 extrusion plants meeting the quality input needs of the industry.
These plants were started not only because of the market forces but also the policy environment was encouraging entrepreneurs to start ventures as in 1977 the Government of India adopted a liberal policy of issuing licenses for importing brass-scrap. It got a further boost in 1989-90 when brass import was put under open general license (OGL) list.\textsuperscript{13}

More recent entrants in the field are computer parts and component manufacturers, besides manufacturers of other high value precision brass parts and components used in electronic and telecommunication equipments. About 50 SMEs are engaged in manufacturing precision items. This phase started in the late 1980s.\textsuperscript{14}

In this manner brass-parts and component industry in Jamnagar beginning with brass buttons in the early 1940s has reached to the state of manufacturing high value precision items in the 90s, traveling through building hardware, screws, electrical parts and component, bicycle tube valves, automobile part and components, sanitary fittings, safety razors, battery terminals and cable glands, bolts, nuts, pencil sharpeners and so on, with an impressive inventory of about 10,000 items at present.

There does not seem to be any logical explanation-historical or geographical- for concentration of the industry in Jamnagar. For,
neither it is a source of raw material (94% brass scrap is imported) nor it offers any large market (almost 99% per cent of the output is sold outside Gujarat). The only factor which seems to offer an explanation is the enterprising nature of the people, their accumulated knowledge and local skills which got built-up over decades. Once the industry started there in the early 40s, it got established and grew.

**Historical Growth of Brass Parts Industries in Jamnagar District**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year</th>
<th>No. of units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1952</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>1954-55</td>
<td>15</td>
</tr>
<tr>
<td>3.</td>
<td>1960-61</td>
<td>250</td>
</tr>
<tr>
<td>4.</td>
<td>1967-68</td>
<td>700</td>
</tr>
<tr>
<td>5.</td>
<td>1979-80</td>
<td>1200</td>
</tr>
<tr>
<td>6.</td>
<td>1988</td>
<td>3000</td>
</tr>
<tr>
<td>7.</td>
<td>1994</td>
<td>3500</td>
</tr>
<tr>
<td>8.</td>
<td>1998</td>
<td>4500</td>
</tr>
<tr>
<td>9.</td>
<td>2002</td>
<td>4000</td>
</tr>
<tr>
<td>10.</td>
<td>At Present</td>
<td>4500</td>
</tr>
</tbody>
</table>

(Source: Indian Engineering Exports-April 2008, Page No.40)
3. PRESENT STATUS OF THE INDUSTRIES

Jamnagar is known as a reputed brass parts manufacturing centre for more than half a century. At present there are 4,500 units engaged in brass parts and component manufacturing in Jamnagar. The industry gives direct employment to nearly 50,000 workers and nearly 1,00,000 persons indirectly.[sidbi]

Beside the 4,500 brass parts manufacturing units, there are 130 electroplating and metal finishing units and about 400 brass foundries. These foundries cater to the needs for raw material of these local enterprises. Of the 400 brass foundries, 20-25 are oil-fired and rests are coke-fired. It is estimated that around 280-300mt of brass scrap is recycled every day.

The value of the products manufactured in this cluster Rs960 crore per annum. Of this, Rs392 crore worth of brass parts is exported and the rest supplied to the domestic market. While 95 per cent of the brass scrap is imported, exports of the brass parts (especially bicycle tube-valves, auto valves, battery terminals and cable glands, builder hardware, safety razors, inserters and other electric items, grease nipple, pencil sharpeners, precision computer and telecom parts and components, brass parts and components used in aircraft/ space craft)
is put at about 20 – 22 per cent of the total turnover. Exports are growing at an annual rate of 15 per cent since the last 5 to 7 years.

The product-wise contribution of output is: Automobile and cycle tube valve-35 percent; Building Hardware-25 percent; Sanitary and bathroom fitting-15 percent; Precision components-5 percent; other categories-20 percent.¹⁶

As mentioned earlier, brass parts and components have wide range of applications especially in the engineering industry. Approximately 10,000 varieties of brass parts are manufactured in this city. Most of these parts and components are turned in 5-10 sized. If we multiply these sizes with the number of parts and component, the range becomes staggering. Almost every day some new part or component is added to the list. However, most of the entrepreneurs manufacturing these parts and components do not know the end use of their product, as they work on the basis of drawings provided by their clients.

Global Presence:
The brass parts manufactured in Jamnagar finds its place in the overseas market as well. Jamnagar is one of the largest automobile and cycle tube valve manufacturers in the world. Because of its precision and quality, these tube valves are exported in European and North American markets. The products are marketed through various
marketing channels to countries like U.K., USA, Canada, Middle East, Europe, Africa, Sri Lanka, Pakistan, Indonesia, Malaysia, Singapore, Japan, Bangladesh, Italy, Germany, Australia, France, Norway, Saudi Arabia, Yemen, Thailand, etc.  

4. FACTOR BEHIND THE DEVELOPMENT OF BRASS PARTS INDUSTRY IN JAMNAGAR

The process of emergence of brass parts cluster in Jamnagar was spontaneous and not induced. A few pioneering entrepreneurs started manufacturing screws, pins and bulb holder. As their enterprises grew in volume and operation, others also followed. So I tried to find out some reason “why industry grew in Jamnagar and not in other parts of the states/ country?”, but the following factors played an important role in fostering the growth of the brass part industry at Jamnagar.

A. AVAILABILITY OF RAW MATERIAL

Raw materials used in brass parts are brass honey, dross of brass, pales in the form of strips and other scrap. This raw material became easily available in and around Jamnagar at a reasonable price. As the industry grew the process of procuring raw material, from within the country and abroad became more and more smooth. Other inputs like coke, molasses and machines were also available locally.
B. SKILLED MANPOWER

Easy availability and low cost of labour was an important factor for the development of the industries. Skilled manpower was easily available within the city and because of higher payments, more and more agricultural labourers, marginal farmers and even salt-workers started learning the skills of making brass parts. Also the level of agricultural development was very low mainly due to scarcity of water so Brass Parts industry was becoming an easy alternative for people. Due to the low-cost labour, getting brass parts manufactured was becoming cheaper for the large industries as compared to imports of these parts.

C. CUSTOMISED MACHINES

The Jamnagar is also known for its ability to manufacture customized machines. Depending on the job, its configuration, local technicians were able to make desired modifications in the existing machines. This provided flexibility in the process of manufacturing, which is considered to be one of the most important facilitating factors for the growth of the brass parts industries in Jamnagar.
D. EXISTENCE OF WELL DEVELOPED PORTS

Jamnagar has a pretty long coastline and the ports developed by Gujarat Maritime Board (GMB) were well developed. GMB has developed two ports viz., Rosi Bandar & Bedi Bandar. These ports had facilities of doing loading and unloading business in the ship. These ports have really contributed in flourishing the export-import business not only for brass parts manufacturing enterprises but also for enterprises involved in manufacturing chemical, fertilizer, textile and salt. Moreover the strategic location of Jamnagar made export-import business easier.

E. FLEXIBLE SPECIALISATION

There are about 10,000 varieties of brass parts manufactured in Jamnagar. The entrepreneurs were able to make wide range of parts having different configuration, dimensions and tolerances. Even the machines are customised locally and made available in the market at reasonable prices. Disintegrated firms and subcontracting arrangement made the manufacturing more flexible and specialised. Even when the buyers placed orders of 200000 pieces of a particular
size cycle tube valve and 25/30 pieces of other sizes cycle tube valves, the manufacturers were able to execute the same.

F. THE SOIL BASE

Though there is no apparent technical reason to support their clay, the entrepreneurs at Jamnagar are of the opinion that the soil (“chikni mitti”) composition also helped in manufacturing quality brass castings. A composition of oil and sand is used in the mould to a particular give shape and size to the brass parts. The more is the binding property of soil and sand, the better is the quality of casting manufactured. The availability of water also ushered the growth of the industries.

G. PATRONAGE FROM GOVT. OF GUJARAT

The Industries Dept, Govt. of Gujarat has facilitated the growth of the industries by providing basic infrastructure and loan on easy terms. In the year 1976, Gujarat Industrial Development Corporation developed the GIDC industrial estate in Shankar Tekri. Land, electricity, water and industrial sheds were also provided amply.
H. ENTREPRENEURSHIP

Gujarat is well known for its entrepreneurs. People here, especially in Saurashtra region (Jamnagar belongs to Saurashtra region of Gujarat) are very entrepreneurial in nature. If they get slightest business opportunity they will not mind to jump on it. As some pioneering people started the business and getting good return on their investment, others did follow. This has happened with diesel engine cluster in Rajkot, Tiles cluster in Morbi etc. The demonstration effect and the entrepreneurial and risk taking attitude of the local people also paved the way for the growth of this cluster.

I. MARKET POTENTIAL

There was enough potential in the domestic market for these parts manufactured in Jamnagar. During the early years, electrical pins, holders, cycle tube valves were marketed in Calcutta, Mumbai, Ludhiana and Delhi. It was the time when buyers from all over the country were eager to get brass parts from Jamnagar and they were ready to make book orders by making advance payments. Moreover, in the early 1960s, the bicycle manufacturers within the country
reduced their import substantially and started procuring it from the domestic market.

Besides, in the late 70s, the leading cycle tube valve manufacturing countries like Germany, Italy, USA, Japan changed their product line from tube valve to precision components. They were interested in making high value products instead of low value ones. They started concentrating more and more on premium product line to get higher value for their product and greater return on their investment. This factor opened a new avenue for the manufacturers at Jamnagar and they started exporting the cycle tube valves to these developed countries during late 70s and early 80s.¹⁹

All these have contributed for the emergence and growth of the brass parts industries at Jamnagar.
5. PRODUCTION ORGANIZATION AND STRUCTURE OF BRASS PARTS INDUSTRY IN JAMNAGAR

The industry in Jamnagar is unique in the sense that almost 98 percent of the production is carried out by small sector industries. Only a few firms manufacturing bicycles tube valves, electrical and electronics items and extrusion plants have higher investments.

As per the field survey and discussed with Mr. Gangadashbhai - chair person of factory owners association the brass parts industries can be categorized as under:

CATEGORY-1:

There are entrepreneurs who import brass scrap and honey and distribute it to the local manufacturers. As per government policy, for booking import orders to the tune of more than 500 tons per annum, one can get 10% discount on import duty. This policy has contributed to the emergence of big importers having financial strength. These importers after procuring the scrap distribute to the manufacturers as per their
requirements. They also get quantity discount for booking large orders. This has become a specialized activity and there are about 20 large importers in Jamnagar.

**CATEGORY-2:**

This group is comprised of casting units. The imported scrap and honey and the locally available pale and dross are melted in the foundry. The melted metal is then poured in the mould to give different shapes and sizes. There are about 400 brass foundries supplying the basic raw material (i.e. casting) to the machining units. Out of this, 20-25 are oil fired and the rest are coke fired. Quality control and standardization is very much important in this phase because any defect in casting can result in making sub-standard parts, components. This is one the most problematic areas in Jamnagar and a lot of technological intervention are required to minimize defects and produce quality castings.

**CATEGORY-3:**

Machining units are the main constituents of this category. Jamnagar is known for brass machining operation. Only by machining the
casted component is given its final shape, size and configuration. There are several types of machines available in Jamnagar like drawing machine, slotting and drilling machines, turning machine, cutting and threading machine, grinding machine, milling machine, etc. In addition to these machines, tools, jigs, fixtures, motors, quality control instruments are also employed for manufacturing brass parts. The most of the value addition is done in the machining phase and there is lot of technicalities involved in the process of manufacturing. Lot of technical training, technology upgradation and implementation is to be carried out in this machining phase.

As per the information collected from Jamnagar Factory Owners Association and other secondary information there are around 5000 enterprises involved in this brass parts machining business.

**CATEGORY-4:**
Plating units engaged in electroplating business are the main constituents of this category. This is the last operation and defects in which can be immediately seen by the customers. It is not necessary that all the brass parts needs to be plated before it reaches the final
customers. Only in specific products, for e.g: electronics and electrical accessories, the process of electroplating is done. There are around 130 electroplating units in Jamnagar. They are basically doing the job work for the large manufacturers.

**CATEGORY-5:**

This group is comprised of dealers, merchant traders, exporters & marketing agents. 80% of the brass parts manufactured in the cluster are sold through these dealers/traders. Only in limited number of cases manufacturers sell their products directly to the customers. Marketing being an important activity in the value chain, entrepreneurs involved in this activity charged premium price for their services. Substantial price addition (with little or no value addition) takes place in this phase. Most of the exporters are located in Mumbai, New Delhi & Calcutta and the manufacturers are supplying their products to various exporters. There are also big traders who procure and sell the product in the domestic market.

About 250 small, medium and large traders/exporters are involved in this business.
CATEGORY-6:
In this category, there are suppliers of machinery and tools, other inputs like jigs and fixtures, molasses, coke, crucible, furnace, measuring instrument, borax, packaging material, etc. These supplies/inputs are required in various stages of manufacturing and finishing process. Though the exact number of the entrepreneurs engaged in this business is not known it is estimated that there could be 200 such players.

6. PRODUCTION PROCESS

It is said that the industry in Jamnagar is capable of manufacturing any brass part or components if it can be turned, however complex the drawing could be. However, these parts undergo a series of processes before they reach the final stage. Major operations involved in manufacturing of these parts and components are:
Production Organisation & Producer – Trader Chain in the Jamnagar Brass Parts Industry
PHASE-I

Procurement & casting

Linkage

Procurement & Casting

Raw Material

(Brass Scrap)

Imported

Locally Available

Importer/Trader

Dealer/Trader

Big Manufacturer

Small Manufacturer

Sorting

Sorting

Sorting

(In house Casting)

(In house Casting)

(In house Casting)
Foundry

PHASE-II

Marketing Linkage

FOUNDRY

\begin{itemize}
  \item Melting section
  \item Molding section
\end{itemize}

- Cock
- Oil
- Electric Induction
- Green Sand
- Permanent

- Pit Furnace
- Pit Furnace
- Furnace
- Molding

- With Molasses Binder
- Without Molasses Binder
- Vertical Mould Casting
- Inclined Mould Casting
PHASE-III
Production Process

MACHINING

Drawing/shaving

Turning/Cutting

Drilling

Threading

Polishing

PHASE-IV

PLATING

Copper plating
Cadmium plating
Silver plating
Cobalt plating
Gold plating
Zinc plating
Nickel plating

Evaluation notes were added to the output document. To get rid of these notes, please order your copy of ePrint 5.0 now.
A noteworthy feature of the brass parts industry in the state is that the entire plant machinery, excepting certain small tools and forming dies, is fabricated in the state itself. The local manufacturers of plant and machinery possess a high degree of innovative genius and, as reported, this single factor has contributed to the phenomenal growth and heavy concentration of the industry in the state. It is this sectors of the industry which works out and determines the process for the
brass parts industry and had been mainly responsible to out wit our formidable competitor- Japan- in the export markets. The local machine tool making industry was also reported to be ever vigilant in designing new and improved techniques of production cutting short uneconomical operations and constantly advising their old and new patrons of the latest methods. They also render prompt after-sales-service to their customers and keep the wheels of production moving without much interruption. They, thus, occupy a permanent place in determining every mechanical process and operation for the brass parts industry in the state.

It is said that the brass parts industry here can manufactured every description of ‘turned parts’. But the turns parts, as they are called in the local usage, undergo a number of processes. The main process and operations involved in turning a brass part are as follows:

- **CASTING:**

  The brass scrap, imported and indigenous, is cast into road of varying lengths and dimensions to suit to the immediate use and purpose.
Brass rods of up to 18 inches length are normally cast by the majority of units. But rods in any size and dimension can be cast, if required.

- **WIREDRAWING:**

  The brass rods are then wire drawn to obtain fine finishing. This process is necessary to give the brass rods an even surface before they are put to machines for turning.

- **TURNING:**

  With the aid of dies and other tools the finished rods are turned into parts and components. This is the main operation through which every brass parts and component has to pass before other operations are performed on it.

- **THREADING:**

  The turned parts are then put to threading operations. This operation is necessary only for the parts requiring threads which are not a common feature to all the components.
- **DRILLING:**
  
  After drawing of threads, or as applicable, the parts are put to drilling operations and drilled as required.

- **GRINDING:**
  
  Parts required to be put through the grinding process are ground.

- **SLOTTING:**
  
  Parts requiring slots are put to slotting operation and the required numbers of slots are made on the parts.
  
  The last three operations need not follow the order given above. They can be interchanged according to the requirement of a part. They have been given here to illustrate the main processes that go into making a whole part but need not follow in every case.

- **CHECKING:**
  
  The finishing parts are then checked individually for machining and other defects and defective ones segregated.
PACKING:

Brass parts are packed in dozens, numbers, gross and kilogram as the packing nits according as the nature of the parts and trade practice applicable to them.

7. THE RANGE OF BRASS PARTS AND COMPONENT MANUFACTURED IN JAMNAGAR

In Gujarat, the brass part industry is mainly concentrated in Jamnagar district of Saurashtra. Jamnagar is one of the largest manufacturers of brass parts and 70% of the machined brass components of this country are produced here. The product manufactured in Jamnagar can be classified under the following categories;

A. ELECTRICAL COMPONENTS:

Cable Glands, Earth Clamp, Lighting Arrestor, Couplers, Male and female brushes; Glen type connection; adapters; 5 to 15 Amperes plug pins; Sockets; flush type sockets; Piano type switch parts; Round and square type switch parts and outlet; Main switch parts -5 to 500
Amperes; Fuse parts; Male and Female coupling; D.P.Switch parts; Toggle switch parts; Tube light starter and refill – pins; Automatic starter parts; Electric motor connection; Electric bell parts, Battery terminal, Electrical Radiator, Electric stove, Electric iron, Electrical immersion heater, Tester and all parts and components involving – Turning, Threading and Drilling operations from 1 mm to 50 mm. size.

B. ELECTRONICS EQUIPMENTS:

Radio: Knob bush; Gauge parts; Twin switch; Band switch; Screws & nuts, Bottom and tope aerial parts.

T.V.: All ‘turned’ brass parts and components.

Telecom: screws and nuts, mouth pair and receiver parts, Computer sockets; other brass fittings and pins as applicable to the instrument.

C. AUTOMOBILES:

Cable parts (all types of automobiles); oil gauge parts (all types of automobiles); tube valves (all types of automobiles); Valve caps for
tyre tubes, Spoke nipple for two wheelers; sparking plug parts; Screws, nuts and washers; Carburetor parts (about 35 in numbers); oil engine parts (about 22 in numbers); Battery terminals; other “turned out” component (25 in numbers) and Grease nipples for all types of vehicles.

D. BUILDING HARDWARE:

Door and window hinges-different size (about 20 in numbers); tower bolts (about 20 in numbers); ball catchers (about 5 in numbers); Door handles (10 in numbers); Aldrops (6 in numbers); towel stand; Mirror stand; Screw and nuts (20 in number), stoppers, knobs, Fan light catch, Hooks and eye, Diortic night latches, Door handle for metric lock, Room latch, Metric lock, Door closers, Flush bolts, Knife nozzle, Studs and other “turned” parts.

E. PENS AND BALL PENS AND PARTS:

Refills; Refill nasals; Push buttons; buttons; brass ball pens and parts (about 50 in numbers)
F. WRIST WATCH WALL CLOCK AND TIME PIECE:

Side bar; button; watch case; alarm buttons; nuts & screws; screw
drivers and about 24 parts.

G. GOGGLES AND SPECTACLES PARTS:

Frame hinges; screw from brass and German silver (2 sizes).

H. TOYS:

Gear wheels; key wheels and sparking points (more than 1000 size)

I. BICYCLE PARTS:

Spock nipple; tube valves; bell parts; lock parts

J. STOVE, PRESSURE COOKER AND PETROMAX:

Tank lid, lower and upper parts of burners; knobs; caps; piston;
pressure gauge; cooler(outside and inside); rising pipe; guide nuts for
cleaning pin; nipples(for firing); pressure valve and whistle knobs,
Burner and its parts- Top portion, Flame ring & burner ring, Nipple, Silencer outer Cp.Inner cap, Silencer burner-full feed pip, Tube type Burner, Burner tube, Burner head, Burner plate, Silencer cap (Outer & Inner), Wire cloth, Fuel container, Fuel feed pipe, Pump tube, Pump valve body, Pump rod nuts & washer, Pump valve screw, Spirit cup, Brass socket

K. SANITRY HARDWARE PARTS:

Ventian blends, Hangers, Tap, Union, Hose nipple, Elbow, Reducer, Tee, Clamp, Extension Nipple, Hex Nipple, Faucet, Bush, Curtain fittings, etc.

L. HYDRAULIC & PNEUMATIC PARTS:

Hydraulic pipe fittings, pipes clamps, Compression fittings, Tube fittings, Hose fitting, Hose connectors, Adopters, Reducers, Speed controller, Coupler, Male and Female Elbows, Bearings, Hex nipple, etc.
M. MISCELLANEOUS:

Surgical instrument parts (about 100 in numbers); sanitary fittings parts (35 in numbers); gas and petrol lighter parts (15 in numbers); novelty items parts (about 150 in numbers); pant belt buckles; camera parts; magnifying glass parts; eye glass parts (for jewels and cotton yarn counting); shoe buckles; rings other ornamental parts and fitting (100 in numbers); key wheels, gear wheels and sparking points; Scientific Instruments; pressure Gauge, Transformers, etc.

In addition to the broad range of products enumerated above, an equally large variety of items is manufactured for industries like shipping and marine Engineering, Aircraft, Computer and Space Vehicles, Locomotive and laboratory and testing equipments, Agricultural implements, various precision machine components as per the customer’s specification. Thus, the field of its application extends to almost every sphere of major and minor engineering activity, though in a small measure. The brass parts manufactured in these industries are mostly machined components and not sheet metal parts.
The Jamnagar Brass part industry has by now developed sufficient infrastructure and is capable of producing/manufactured in remunerable sizes and dimensions. An article published by Jamnagar Factory Owners’ Association indicates that about 10,000 varieties of brass parts are manufactured in this city. Practically all these parts are machined parts; there are hardly any or very few brass sheet metal parts and single piece casting parts. Barring few items like builder hardware, most of the items are ancillary items and used by other industries for their products. The products in terms of its weight ranges from less than 1 gm. to 10 kg. And in terms of its length and diameter it varies from .05 mm to 60 cm. in general and in specific cases it may vary. It is estimated that 280 to 300 mts. of brass scrap is recycled everyday. It is, therefore, not possible to list here all the specification, sizes and whole nomenclature of items manufactured by the industry in Jamnagar. The broad range listed above is indicative of the multifarious uses the items can be put to and the nature of their usefulness seems to be unlimited for all times to come. This fact naturally leads one to infer that there is hardly any engineering item which is complete without brass parts and to some extent the inference is true.
Analysis of business operation (problems identified)

Just some years ago, the turnover of the industries began to decline as entrepreneurs faced increasing competition from abroad. The problem became more severe after liberalization of economy. There was a time when Jamnagar was the largest supplier of cycle and automobile tube valve in the world. Now China, Taiwan, Germany and Italy are posing fierce competition for the brass parts manufacturers in Jamnagar. The domestic market also stopped growing at the same rate as it did during the late 80s and early 90s. cost based competition became the rule of the game. Besides, the process of manufacturing and the practice of marketing did not change much since the inception of the cluster. There was hardly any advanced technology induced in this cluster. Because of not getting regular market for their products, a large number of enterprises had to close down operation in the year of 2001.

The following section presents an analysis of business operations for the brass parts industries. The analysis is built on the following factors viz.
1.1 Raw material

The raw material requirement of the brass part industry is met mainly from the following three sources:

- Old brass, copper and bronze utensils
- Imported brass scrap and honey
- Brass scrap from ship breaking yard
In old days, there was a practice of using brass, copper & bronze utensils in the households. But with the change in consumer taste and preferences, more & more people in India stated using stainless steel utensils, which was easy to clean and maintain. Thus, the old brass and bronze utensils are sourced from all over India and used by the foundry owners at Jamnagar.

As a matter of fact, 90% of the raw material requirement of this brass parts cluster is met through imports. The countries from which it is imported are USA, Singapore, Gulf and European countries. The imported raw material is available mainly in three forms

a. Honey scrap
b. Dross of brass &
c. Pale in the form of strips

The quality of brass scrap and honey varies widely and its composition is not uniform. Any part, components, equipment, machines, which has some copper/brass as its base material, is imported. Most of the times, this scrap are made of two to three different metals and the job of the
worker is generally separating other metals (like aluminum, iron) from the copper and brass. It is a tedious process but still in practice in Jamnagar. Moreover the separating process can never be 100% accurate and lot of impurities and other metals reach the foundry for melting. As a result the quality of casting is affected.

Technically speaking brass is an alloy of copper and zinc and the ratio of these products is 60:40 (60% copper & 40% zinc). For getting the right products and good quality, it is important that this 60:40 composition is maintained. However, due to heterogeneous nature of the scrap (honey) and different alloying of the base metal, it becomes almost impossible to maintain this 60:40 ratio. As a result, the quality of the final product varies, defects are produced and the rejection rate increases.

The best method of getting the right quality and right alloying is using copper and zinc ingot. But because of higher price of ingot, scrap is used as the basic raw material. Because of cutthroat competition,
manufacturers are not getting the right price for their products. This price war (on final product) compels them to use cheaper raw material.

The ‘dross’ of brass which is technically known as ‘slag’ and is actually the impurities produced in casting process. In technologically developed countries this is never used. In Jamnagar even the brass particles collected (separated by vibrating separator) from the dust is also used for casting. The percentage of brass in this dross is very minimal. Pales are generally are of good quality and are used for producing quality casting. It is estimated that about 280-300 mts. of brass scrap is recycled in a day.

1.2 Machinery & production:

There are 10 to 15 types of machines used in the brass parts manufacturing cluster at Jamnagar. Some of these machines are wire drawing machine, slotting & drilling machine, turning machine, threading machine, wire straightening machine, grinding machine, milling machine, etc. Depending on the precise nature of products to
be manufactured and the processes it has to go through, the requirement of machines varies. Though there is no generic manufacturing process but most of the products have to go through the following machining operations.

(After Casting)

↓

Drawing/Shaving

↓

Turning/Cutting

↓

Drilling

↓

Threading

↓

Finishing

↓

Plating
Jamnagar is known for its customized machines. There are some very good technicians/mechanics who can copy any imported machine or machines of reputed companies. An imported machine which costs few crores can be copied and manufactured at a price of a few lacs. These machines are made available locally. The designs are customized to fulfill the requirements of a particular job. This is one of the greatest strength of Jamnagar brass parts cluster. This gives flexibility in operating practices. Majority of the entrepreneurs are using these customized machines.

The process of manufacturing has mostly remained traditional. The process of melting machining, polishing and plating did not change much for the last 50 years. There is no temperature recording and temperature controlling devices in the foundry, no automatic machines, pressure die-casting machine, and barreling and electropolishing plant. As a result, the industry is facing problems like coring and segregation, pinholes and blowholes, shrinkages, dimensional distortions, etc. As a result, rejection rate is higher and lot of parts and components are used for recycling.
Lot of machining operations are carried out which either could have been minimized or eliminated. For example, for manufacturing a 2 mm. screw the casted rod which is of 5-6 mm. in diameter is turned/shaved repeatedly. This operation takes a lot of time and labour. The process can be completely eliminated if the technology of paste brazing is adopted.

Some of the parts manufactured in Jamnagar require very precision tolerances. For example, the cycle & automobile tube valve require precision measurement. This precisionability is obtained by manual filing and other operations. Because of not having the right technology, the rejection rate is very high. However, a pressure die-casting machine can help in getting precision parts and components at a much faster speed. This will eliminate the manual filling operation. Moreover, there are very few micro-meters to check the micron value of the products. There are entrepreneurs whose exports were turned down because of inability to maintain the precisionability of products.
1.3 Products & marketing:

There are about 10,000 brass parts manufacturers in the cluster. This was possible because of flexible (specialization) operating system. Whatever be the volume of orders, the entrepreneurs in this cluster are able to meet that. They are capable of handling orders which are as small as 50 pieces and big as lakhs of pieces. The sub contracting arrangement is widely prevalent in the cluster. Incase, an entrepreneurs does not have some machine, he can get it done in some other factory. The availability of customized machines and skills of the operators also provided impetus to growth.

The products are marketed within India and abroad. There are enterprises which have ancillary arrangement with the parent unit and supplying components for a long period of time. This is mostly prevalent in cycle tube valve manufacturing sector. Cycle tube valve manufacturing have tie-up with the leading cycle manufacturers in Ludhiana. (M/s Atul industries in supplying cycle tube valve to M/s Hero cycles Ltd. For the last 16 years). In other cases, the products are marketed through traders/ dealers. Jamnagar is known for cycle tube
valve, electrical and electronic accessories and building hardware items and these products are supplied all over India.

The products are marketed abroad too. Jamnagar is well-known for Automobile, Cycle tube valve, Building hardware and Sanitary fittings. The products are exported in countries like UK, USA, Canada, Middle East, Europe, Africa, Sri Lanka, Pakistan, Indonesia, Malaysia, Singapore, Japan & Bangladesh. Though there are some enterprises which are supplying brass parts directly to the customers in the importing countries but most of the exports are through agents/traders. Generally, the brass parts manufactured in Jamnagar are sold to the exporters located mainly in three cities viz., New Delhi, Kolkata and Mumbai. They in turn sell these products to their fixed clientele abroad.

In the area of globalization, the marketing activities of the entrepreneurs, needs to be integrated in order to capture the global market. As the units are small (with the exception of a few vertically integrated units), it is almost imperative that networking is done in
order to capture largest export orders. This will not only ensure economies of scale but also developed accountability of the entrepreneurs. Export consortia can be formed to ensure brand building, participating in international fairs, negotiating with buyers, compete with other countries on quality and price fronts.

In earlier days Jamnagar has a niche market in Arab and African countries. The entrepreneurs had fixed clientele in these countries. However, after globalization these countries are started procuring from countries like China, Taiwan, Thailand, Japan etc. Competition now-a-days is severe and the only way of survival is quality and price. This is all the more important because product differentiation is gradually disappearing.

In the present scenario the entrepreneurs can join hand together, from consortium and grab large export orders. There can a brand building initiative where all the Jamnagar products are projected under one brand name.
1.4 Entrepreneurs and their enterprises:

A majority of the enterprises are family owned. The owner and other family members are the manager, operator, marketer, technician, and negotiator. There is hardly any qualified people recruited from outside. As a result no fresh idea came up and the process of manufacturing remained traditional. One needs to understand that there are several functional areas in an enterprise where qualified and experienced persons are required.

The level of awareness of the entrepreneurs; especially in technical and marketing areas, is not as high as it should be low level of education and inability to communicate in English have remained a major problem for them. There are entrepreneurs who are looking for certain machine, (e.g., pressure die casting machine) for the last 15 years but could not source it, while these are used widely in developed countries. Even in India, Hindustan machine tolls are manufacturing this machine. It is also extensively used in Central Ordinance Factory, Jabalpur and large industries like TELCO, Bajaj etc.
Whatever manufacturing processes are available in the enterprises, it was developed in the process of coping others. As somebody started melting scrap in a typical crucible or making thread in a particular way, others just copied it. Outside interventions are minimal, especially in technology. At present there is no temperature controlling and measuring devices in the factory. In case one gets them from somewhere, others will follow.

1.5 Finance & working capital:

Finance has never been a problem for the entrepreneurs at Jamnagar. Sometimes excessive credit given to the customers creates temporary shortage in working capital. Otherwise finance is easily available with local banks (lead bank being State Bank of Saurastra). However stringent competition, compelling the manufacturers to supply at less remunerative price, sometimes may create shortage in working capital.

The machining units are well organized in financial planning. Their financial controls and accounting systems are up-to-date and hence
they are able to provide right information, balance sheet and profit and loss account to the satisfaction of term lending institutions and banks for getting working capital and term loan. However, cost of the machines being less the entrepreneurs hardly approach bank for term lending of their new machines. They have their accountant (mostly part time) to look after their accounts. The export oriented units are effectively utilizing the export credit facilities

For establishing a foundry one hardly needs any term loan because no machines are required and only crucible and furnace are necessary. However, due to high cost of brass and high turnover, the working capital requirement is high. This is either managed from internal sources or loan is taken from the bank.

The money required for establishing a plating shop is not high. The same is either managed internally or loan is taken from bank.
1.6 Manpower:

Skilled workers are locally available to run the machines. Whenever a technician/worker are required a notice is displayed in the main gate of the factory. Some of the jobs which otherwise could have been done by machines are done manually.

However, there is hardly any engineer employed in these enterprises and the production process remained traditional. This is one of the lacunas of the Jamnagar brass parts cluster. One of the main reasons of the technological backwardness of this cluster is nonexistence of experienced engineers. Even there is no experienced HRD, marketing personnel and the business remained family oriented. Hiring experienced people in the above field necessitates higher pay, which the entrepreneurs are not willing to offer. Moreover Business Development Services in technical and marketing area is difficult to find.
It is important that entrepreneurs in this cluster understand the importance of each functional area and the advantages of hiring experienced people.

There are no training facilities/ institutions available in Jamnagar. The workers learn on the job and by observing others. However, the experience of working in one factory is utilized in another when he/she joins the later one. Even R&D institutes and quality testing laboratories are non-existent.

1.7 Infrastructure:

The enterprises are located in four areas called Shankar Tekri, Patel Colony, M.P Shah Udyognagar and Digvijay Plot Area. In the year 1976, Gujarat Industrial Development Corporation set up GIDC industrial estate at Shankar Tekri. Another GIDC industrial in M.P.Shah Udyognagar was established subsequently. In these industrial estates, land is provided and arrangements were made for provision of electricity and water. As a result, the industry flourished. In the year 1976, there were around 1000 enterprises now it has gone upto 4000.
However, alike other industrial estates in India, there are problem of power cuts and the road conditions are not conducive. Due to frequent power cuts production is hampered.

1.8 Business development services:

The business development services have not grown much in Jamnagar as it has been in other industrial clusters. There are no technical training institutions, no R&D laboratory, no management institutions, no testing facility, no marketing expertise, and no design development institute available in Jamnagar. It is difficult why these services have not developed in Jamnagar because; in most of the cases these are demand-driven. Probably, the requirement of the cluster is not properly projected. Therefore, there is a need to have networking and consortium among the SMEs in the cluster.

National Metallurgical Laboratory, Jamshedpur is one of the premier institutes working in the field of metallurgy and metal sciences. It has developed several technologies which have application on various types of metals. A branch of this laboratory can definitely be established at Jamnagar for the benefit of the cluster.
Similarly, technical training institutes and testing laboratories can be developed to fulfill the requirements of the enterprises.

1.9 Others Problems

**Trust Factor:** Most of the industries were operating in isolation and on their own. They were reluctant to share any problems or plans. There was hardly any development activity pursued jointly. The advantage of cooperation and the ‘gains’ of collective efficiency could not be realized. There was no mutual learning. There was only hardcore business relationship with little transfer of information and knowledge.

To address the above problems, special emphasis was given on marketing, financial and skilled labour.
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