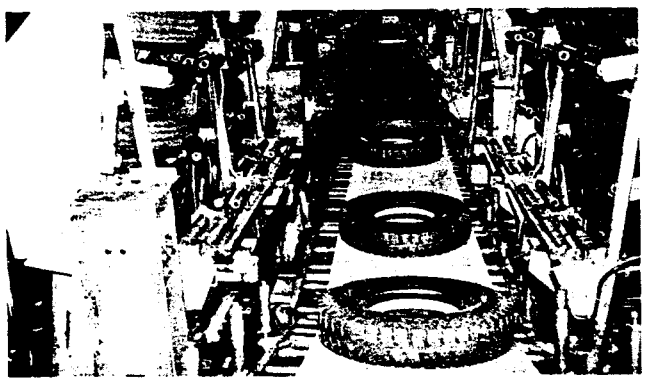
Tire Making Plant



Conveyer of Tire Press

Since the development of practical cars at the end of the 19th century, the automobile industry has attained a rapid advancement, resulting in the realization of a great revolution in the means of transportation.

In the 20th century, in particular, the car industry has developed as an essential part of the overall machinery industry of a nation, occupying a weighty position to the extent that the life of people in modern times is unthinkable without cars.

On the other hand, the development of car industry owes greatly to the emergence of rubber tires, with the growth of the car industry naturally linked to the growth of the tire industry. The tire industry now has formly rooted as one of the important key industries worldwide.

In the meantime, the tire industry occupies an absolute weight from the standpoint of rubber industry. In Korea, for instance, it accounts for approximately one-third of the total turnover of the rubber industry with the prospect that its weight will greatly expanded as the car industry continues to develop.

The importance of the tire industry is understandably conceivable in view of its being a labor intensive and basic industry with a weighty position in the industries of developing and underdeveloped countries.

The tire industry is in the limelight not only in domestic market but also in export markets. In Korea, for instance, since its initial export of tires in 1962, a rapid export growth of 40 to 50 percent was recorded during the 1970s. It is foreseen that such a rapid export growth will be sustained with the expansion of the car industry worldwide.

Consequently, the tire industry not only plays a vital role in fostering and developing the basic industry of a nation, but also contributes greatly to the advancement of the export industry. It is rated as an industry to be inevitablly fostered for the economic development of a nation in recognition of the importance of the tire manufacturing plant from this viewpoint.

Products and Specifications

In this plant, various tires of varied patterns and specifications are produced, breaking down into the following categories on the basis of respective uses:

- Passenger car tires
- Light truck tires
- Truck and bus tires
- Snow tires
- Off the road tires
- Industrial tires
- Agricultural tires

By types, general tires as well as radial tires making use of such materials as steel, fiber glass, polyester and nylon are being produced now. Also included in the production list are wide treaded tires with added sense of comfort.

Contents of Technology

1) Process Description

The manufacturing processes for products (tire, tube and flap) are divided into the mixing process, treating process in which component parts required for building products are prepared, building process where component parts (semi-products) are collected for fabrication of products and vulcanizing process in which vulcanized rubber is produced by means of thermal vulcanization reaction (see process diagram).

Compound mixing process

The mixing process breaks down into mastication and mixing work. Crude and synthetic rubbers as raw materials are accurately weighed.

Mastication is necessary to improve the rubber prior

to mixing as to its calendering and extruding properties. Mixing takes place in a Bambury or open mill batchwise with a fixed volume for prescribed hours. The temperature is kept constant by means of cooling water. The green stock (blended rubber) with various uniformly-mixed blending materials are left alone for an appropriate length of time depending upon its uses (calendering and extruding).

Treating and building process

In this process, the blended rubber (rubber sheet), prepared in the mixing process, is calendered (cord) and molded as component part required for subsequent building. The required number of topped cord sheets are pasted together and beads are fixed on its both sides, with cushion rubber pasted together in the center. When the tread rubber is pasted, the building work is completed to be called the green tire (crude tire).

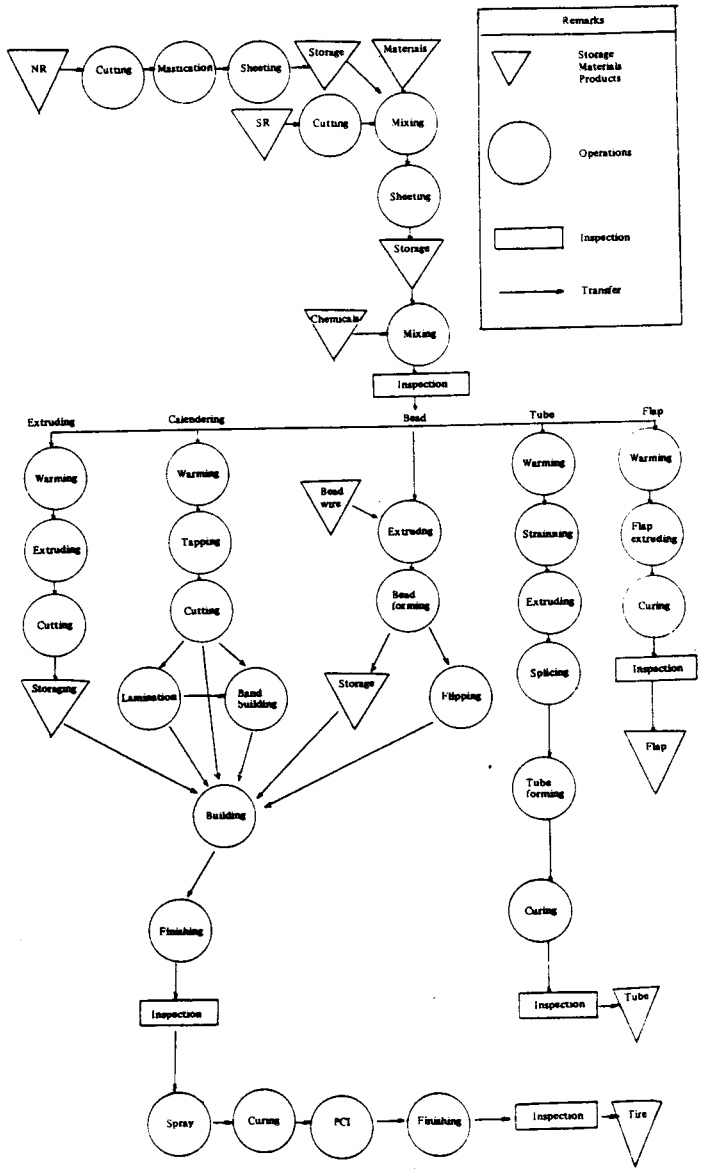
Vulcanizing process

The green tire, that is to say the built tire, is inserted into "Autoform" for an automatic vulcanization. The mold is already in the "Autoform" and the vulcanizing work takes place for a fixed length of time in the mold by heating and vulcanizing.

By supplying high-temperature and high-pressure steam or hot water into the bladder attached to the "Autoform", the external form of a tire is molded in accordance with the fluid of rubber. The tire is automatically expanded on completion of the vulcanizing work to be followed by cooling to form the final product.

Tubes and flaps are extruded, cut, spliced and cured in the same way as tires. After completion of the vulcanizing reaction at constant temperature for a fixed length of time in vulcanizing work, the product is

Tire Manufacturing Process Digram



taken out immediately for cooling. The finished product is inspected and stored.

2) Equipment and Machinery

- Tire plant

Mixing section
- Bumbury mixer
- Single mill
- Batch off machine
- Dust collector
- Carbon auto batching unit
- Stock feeder
- T-mixer
- Truck scale

Calendering section
- Calender and train
- Twin mill
- Conveyors
- Hoist unit
- Air conditioning unit
- Gum calender and train
- 2 Roll calender
- Twin mill
- Single mill

Extruding section
- Tread extruder & line
- Cold feeder
- Cushion calender
- Liner & final scale
- Conveyors
- Blowers
- Twin & single mills
- Dual tuber
- Skiver

Cutting section
- Fabric bias cutter
- Steel cutter
- Sliter machine
- Rewinding machine

Beading section
- Bead train
- Hexagonal bead train
- Bead wrapping machine
- Apex applicator

Banding and building section
- Band builder
- Bias PC building machine
- Bias LT building machine
- Bias TB building machine
- Radial PC first building machine
- Radial PC second building machine
- Radial TB first building machine
- Radial TB second building machine

Curing section
- PC tire press
- LT tire press
- TB tire press
- PC bladder press
- TB bladder press
- Cold blander

Finishing section
- Trimming cutter
- Tire uniformity machine
- Balance tester
- X-ray tester
- W.S.W. grinder
- Endurance tester
- Conveyors

- Tube & flap plant
  - Mill
  - Strainer
  - Extruder & line
  - Tube curing press
  - Flap press
  - Splicer

3) Raw Materials and Utilities

- Tire, tube & flap plant

Raw materials and utilities	Requirement (per ton of product)
Natural rubber	260.2 kg
Synthetic rubber	231.9 kg
Carbon	240.9 kg
Cord	90.3 kg
Accelerator	28.2 kg
Softener	54.4 kg
Others	92.1 kg
Bunker-C oil	1.32 drum
Electric power	828.0 kwh

Note: Based on tire plant capacity, 350 tons/days, and tube and flap plant capacity, 40 tons/days.

Example of Plant Capacity and Construction Cost

1) Plant capacity : 1,560,000 pcs/year
   * Basis : 24 hours/day, 320 days/year

2) Estimated Equipment Cost

o Manufacturing machinery	:	US$34,080,487
o Utility facility	:	US$ 3,658,536
o Installation cost	:	US$ 3,408,000
Total	:	US$41,147,023

3) Required Space

o Site area	:	108,658 m^2
o Building area	:	32,132 m^2
o Other	:	76,526 m^2
Total	:	108,658 m^2

4) Personnel Requirement

o Manager	:	4 persons
o Engineer	:	35 persons
o Operator	:	144 persons
Total	:	183 persons