

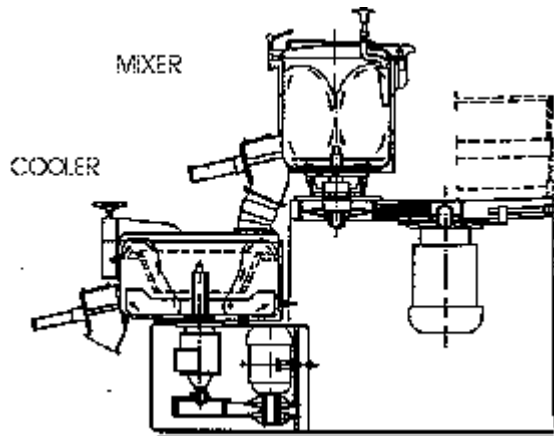


# EMPAQUES PLASTICOS DE MEXICO S.A. DE C.V.

## PROCESS DESCRIPTION (PVC FILMS)

### PROCESS DESCRIPTION

With the term films usually are designated plastic material of flat or sheet form with gauges of very thin thickness, in the range of 0.10 to 10 (0.001"). Several techniques for the production of plastic films exist, most of them based on the extrusion of a resin through an opening with pre-defined form. And between these, the simplest technique and the most common is blown molding. The blown film process uses an extruder equipped with a circular die for which it is extruded a plastic resin in order to form a kind of a tube that later will constitute the final product. A typical extruder consists of a mechanism of transmission and power, of a cylinder, of a screw, of a filter mesh (optional) and of the appropriate controls of pressure, temperature and speed. In the process resins of high molecular weight are used because they maintain the extruded form during cooling but before using them they should get ready by means of the blending of diverse additives that they give you the characteristics that you want to impart to the final product or that they help to their appropriate processing.



High-speed blender for the PVC Compounding. \*ENCICLOPEDIA DEL PLASTICO IMPI



Fethil Industrial Machines Images

The operation principles of an extruder form the base for several important production processes of plastic articles. An extruder fuses, compresses, mixture and pumps the plastic material to the forming section. The forming section is usually a die with an exit that gives to fused material the form that is wanted to obtain by means of a continuous process, how they are: sheets, pipes, profiles and another. In the subsequent stages this initial form is used as a base in order to give the product their final form. A typical cut of a single screw extruder is shown in the following figure:

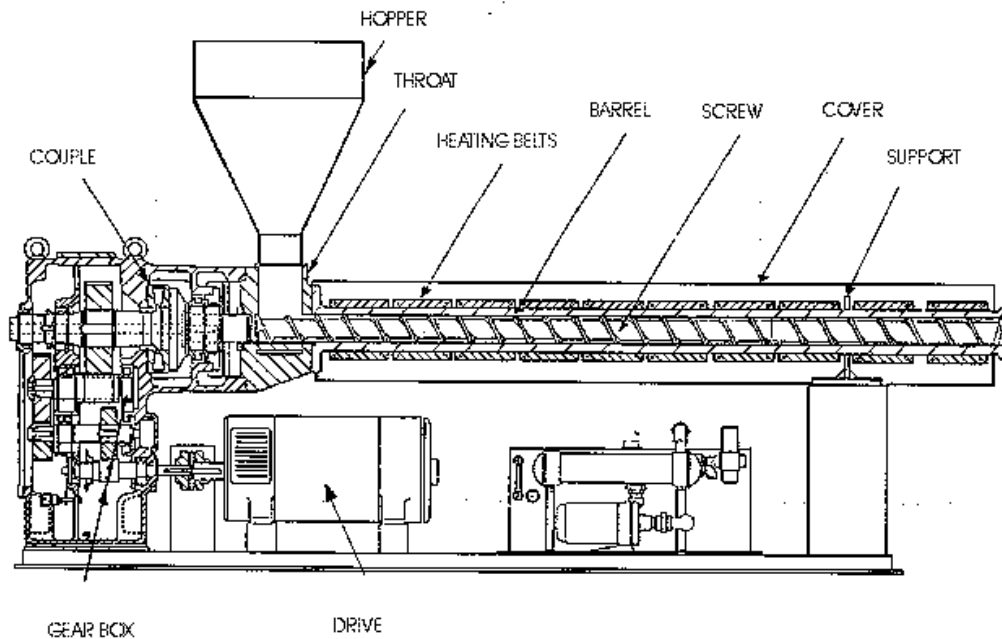
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## Typical Single Screw Extruder.\*ENCICLOPEDIA DEL PLASTICO IMPI

A motor either of variable or fixed speed, make give turns to a screw inside a cylinder electrically heated by resistance means. The plastic material is gravity fed into a hopper through an opening in the cylinder. The plastic is transported for the screw and absorbs heat, so much of the cylinder, like of the friction effort. As the plastic is gone fusing, the channel of the screw is littler, increase the internal pressure forcing to the material to leave for the die. Once the fused material has the basic wanted form it go over to the section of final forming.

In the blown film process, as the resin is extruding through the circular hole, air is introduced for the die in order to inflate the plastic material and forming something similar to a great bubble. The formation of the bubble stretches and thins the fused material until reach the wanted measure and thickness. As the plastic cools down, it become hard and after a cooled enough, the bubble is collapsed between two rollers and winded in form of roll. This product form is normally well known like tubular film. But subsequent steps could cut the roll longitudinally in order to give flat films with greater practical utility in the production of bags or diverse packaging, or to the width in order to form single sheets. The whole

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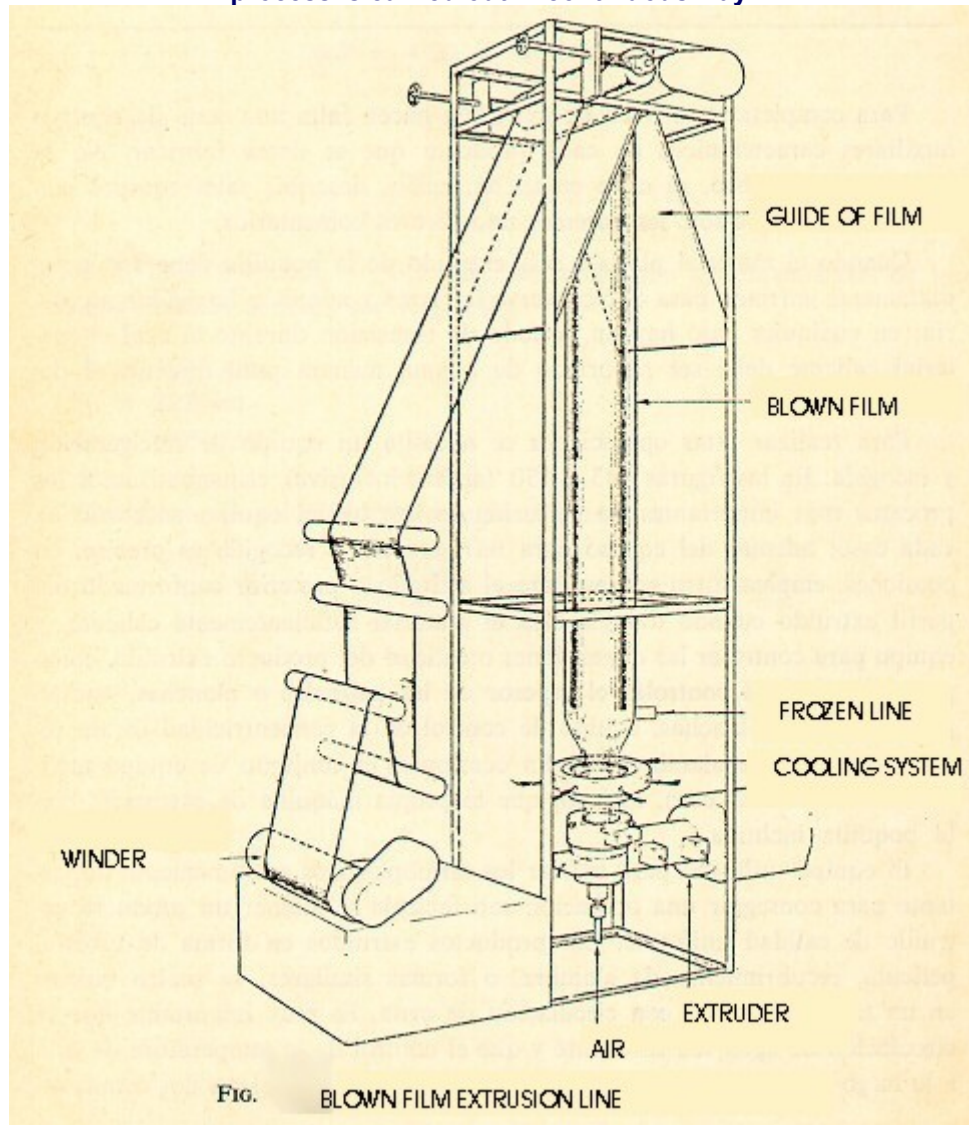
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process is carried out in continuous way.



\*EXTRUSION DE PLASTICOS. TEORÍA Y EQUIPOS. R.ANGUITA

Diverse variations in machine designs exist in order to give greater production, with greater or minor efficacy degree or automation, but all are based on the same principle.

Another auxiliary operations in the film production process are:

The initial preparation of the material, in which mix the better compounds proportions, additives, recovered material or pigments that require each different resin or product type.

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The grind and classification of all the plastic waste, that permit optimizing its handling for recycling.

The revision, classification and final packing of the finished product.

## RAW MATERIALS REQUIRED BY THE PROCESS.

In manufacturing of plastic films many types of thermoplastic resins are used, almost always polymers of high molecular weight that allows to obtain resistance in hot. The low-density polyethylene, the high-density polyethylene, the PVC, and the polypropylene constitute most of the volume in this field. Other materials less common is the K resin, the polystyrene, polyesters, etc. due to their low cost, to the ease processing, null toxicity and good chemical and physical resistance, besides being unnecessary use sophisticated machinery or special formulations, the polyolefins (polyethylene, polypropylene, etc.) is those of wider use, and by means of the use of especially modified equipment the PVC films are next in importance, for what we have limited use to only manage this type of resins.

These materials are provided by petrochemical industry that by means of diverse chemical processes obtains them generally starting from the petroleum and provide it preferably in form of pellets or granules packed in bags of paper or plastic, or sometimes like in the case of the PVC in form of powder. In Mexico, the resin purchases are made generally to specialized companies dedicated to import and commercialization or like in the case of the PVC resins the acquisition is made directly with the national producers. The additives for the resin is acquired with national makers or with representatives of international companies that market the several products.

In order to obtain a certain product, plus to the resins is necessary add other auxiliary substances that help to process the material or to improve their properties. Between the several types of additives that we used in order to elaborate our formulations they are:

**Plasticizers.** They are liquids of low boiling point that are added to the polymers in order to improve their flexibility, stretching and easy processing. They act separating the chains of polymer, reducing the intermolecular attractions and promoting a greater mobility.

**Thermal stabilizers.** Are substances that allow controlling the extreme susceptibility to the degradation of the polymers permitting their processing in this way. They also have the purpose of neutralizing and react with the hydrochloric acid that is generated for the resin degradation, preventing the discoloring of compound during the transformation process. Should be: receiver of hydrochloric acid. The products that are formed with they should be insoluble, non-odors and resistant to the water. Not presenting problems of compatibility. Being absorber of ultraviolet light. Being not toxic and use in small amounts.

**Lubricants.** They improve the processing of the polymers reducing the friction between the particles of the material and retarding the fusion of the same. They also reduce the viscosity of the fused promoting the good flow of the material. They avoid the hot polymer adhering to the surfaces of the processing equipment and improve surfaces of the product.

**External lubricants.** Reduce the friction between the particles of the polymer and the metallic surface of the machinery.

**Impact Modifiers.** They give greater resistance to the impact to lower temperatures and impart flexibility to rigid compounds.

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**Process Helpers.** Improve the polymer processing without affecting their properties and reduce the surface defects.

**Other materials of importance** and that they are managed much minor in volume they are: pigments and additives for give specific characteristics to the product or to improve their visual aspect, tubes of cardboard for the winded product, and packing materials: paper, boxes, bags, etc.

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