The Planetary Roller Extruder

Extrusion and Mixing Technology for the Industry

ENTEX®
ENTEX at a Glance

As trend-setter and technology leader we are familiar with the following industrial fields of application:

- **Plastic Industry**
  all PVC formulations, filled Polyolefin, ABS, TPO, TPU, PE, PP, PET, duroplastic moulding material, Prepex, UV-stabilizers etc.
- **Elastomer Processing**
  rubber processing, elastomer adhesives etc.
- **Colour Industry**
  epoxy-, polyester-, acrylic-, hybrid lacquers etc.
- **Chemical Industry**
  blends with endothermic and exothermic reactions, drying and degassing
- **Food Industry**
  all thermal sensitive formulations like cocoa-sugar-dispersion, ice cream and special malt etc.
- **Pharmaceutic Industry**
  pelletizing of hydrophobic and lipophilic active substances
- **Roller Technology**
  calender rolls, polishing rolls and vacuum nap rolls at thermodynamically highest stage

Founded: 1986  
Employees: 120 (11 trainees)  
Based in: Bochum, North Rhine Westphalia  
Product range: planetary roller extruders/-mixers, reactors, cooling conveyors, calender rolls, vacuum nap rolls, film production lines, dosing units and stuffing devices etc.

Development: 113 intellectual property rights and intellectual property rights registration (processing and production technology)

Sale: worldwide

New view of ENTEX
Plant Layout and Construction

Together with our customers we plan the processing technique of tomorrow. The art of the process technology is in omitting. Today there is more and more the tendency from the discontinuous to the continuous process technique.

With regard to the logistics becoming more and more expensive, the process technology must be designed simple, economical and safe. When considering today the discontinuous compounding this is featured by conglomerates (big chemical factories), batch processes and a comprehensive logistic to the final consumer. The process technique of tomorrow is marked by the proximity to the final consumer and good controllability.

For this the planetary roller extruder offers the basis like no other aggregate. Due to its unique thermodynamic and the modular construction, processes can be scheduled which are discontinuously not possible.

The construction of the planetary roller extruder holds a multitude of possibilities for mixing, homogenization, degassing, injection and feeding.

The planetary roller extruder of the past only knew one roller part. Due to product insufficiencies the roller part has also been divided which resulted in a decrease of the throughput capacity.

In the ENTEX Technical Centre the today's planetary roller extruder can be equipped with up to 8 roller parts. Gravimetries and pre-batching make a supply of more than 25 components possible. Due to the patented multifunctional designed intermediate stop ring the temperature and pressure can be measured and the different additives can be injected between every roller part.

Furthermore, this zone can also be evacuated by insertion of a simple ring. Solids or degassing can be realized in every modular section by means of the side feeder.
The Planetary Roller Extruder

The principal item of the roller extruder is an ENTEX planetary gear with an extreme toothing width and a helix of 45°. At the rotation of the central spindle the planetary spindles are rolling on the central spindle and the internally toothed cylinder assembly and rotate like planets. During this process the material will be caught and by the plunge of the spindle teeth into the corresponding tooth space the material will be drawn-out into thin layers and brought forward by means of the helix.

This repeated thin-layer rolling-out enables an exact temperature guidance during the whole compounding process.

A further step of development of the planetary roller extruder is the modular construction. At the modular construction up to 8 cylinder assemblies will be coupled together. Thus the procedural path will be designed anew again and again. Contrary to the former extruders, dwell time and pressure build-up for example can be widely varied due to the modern spindle combinations. With regard to the process technique the planetary roller extruder outclasses the known corotating mixing twin-screws.

Advantages of the Planetary Roller System
- repeated thin-layer rolling-out
- thus most precise temperature control of all compounding systems
- gentle material compounding
- large processing bandwidth of most different materials
- quick and trouble-free change of material
- best self-cleaning effect, thus smallest waste quantities
- modular construction
- critical processes
- ecological production with nearly no risk
- cost-saving and high-quality production
- sanitarily closed system

The ENTEX planetary roller extruder demonstrates the ideal symbiosis between thermodynamic and shape stability, i.e. here the wall thicknesses for the heat transfer are realized by the construction of the roller parts, which is only possible by this system. At a diameter of 250 mm the wall thickness is 3-4 mm, in spite of this, the machine is in a position to withstand a pressure of more than 1000 bar.
Since approx. 60 years the planetary roller extruder is in use for the compounding of thermal critical PVC formulations. The planetary roller extruder was significantly involved in the triumphal procession of the packing films and the technical films made of PVC. Out of the aggregate for PVC films and powder coatings arose today an extrusion system for the processing of PVC, TPO, PE, PP and all other polymers as well as elastomers, adhesives, food and chemical processes.

Our new developments brought our customers into market leader positions. Whether Prepex, recycling, rubber, plastics, adhesives or shrink films as well as chemical reactions, our production lines make our customers yet bigger. The great advantage: by purchasing this production line you are, with regard to the process technique, equipped very well for the future and all further developments. Tomorrow you have to change the process, you have bought the production line today or even 40 years ago. Due to the ENTEX technology processes, also old production lines are extendable to the today’s state-of-the-art, provided the torques will suit.

The modular system „planetary roller extruder“ suits always. For example, the TP-WE 250 out of the past can be equipped with an extrusion part TP-WE 280S. S stands for massive design, enlarged module 3,5 to 5,5, thus the 2,25-fold wear volume. Due to this step more wear-resistant materials become possible.

For special fields of application this results in a more than 5-fold amelioration of lifetime.
A market becoming more and more important in the elastomer range is insulation materials (elastomer foams), insulations, profiles or as well adhesives. In the past, even rubber masses have been processed nearly exclusively by means of discontinuously working internal mixers. They have been processed to profiles, sealing strips or products similar to tubes, with and without fabric inlay, via roll mills and roller combinations or by pin extruders. Of course, fluctuations in quality cannot be avoided when using the discontinuous process.

The batch process always leads to great fluctuations in temperature. Of course, many formulations have been adjusted to this process. Also here the planetary roller extruder offers a new dimension. Up to 25 solid components – even more – can be supplied to the continuously working process of the planetary roller extruder and up to 10 liquid components can be injected. A planetary roller extruder with three roller parts in two-stage design is in operation since 2001.

Mistakes in the formulation or supply will be visualized immediately. Opposite to the discontinuous compounding we experience a significant decrease of the risk potential and the emission, because the system is a closed one.

The second stage is a degassing stage with downstream mixing stage. Here the diameter of the planetary roller extruder is 300 mm, the output capacity amounts to more than 1,200 kg/h. In order to align oneself to the requirements of the market we recommend laboratory extruders. Our customers worldwide complied with this recommendation. The laboratory extruders are equipped in that way that torque, temperature and speed can be collected at any time. By this the continuous compounding is connected with a minimization in risk.
Technology for Thermoset Materials

Due to its thermodynamic the planetary roller extruder is – no doubt – the most suitable machine of all compounding systems to process high reactive thermoset masses. The thermodynamic of the planetary roller extruder enables an absolute temperature constancy, which involves that the particles thus can be mixed evenly and thereby compounded nearly up to the limit of the reaction.

Due to the kinematics and the energy transport of the planetary roller extruder there will be at no phase of the compounding a reaction. Also at changes of the operating parameters (throughput capacity, temperature etc.) the reaction of the thermoset material can be influenced immediately by the water heating-cooling of the planetary roller extruder. Due to the installed quick cooling a reaction will be interrupted immediately in case of power breakdown so that a re-starting of the process will be possible without problems.

The excellent self-cleaning of the planetary roller extruder and the therewith connected minimization of dead spaces take care that no preterm reaction takes place in the planetary roller extruder. Due to the self-cleaning behaviour of the planetary roller extruder also very critical formulations can be processed.
Another economic technology is the segmentation special developed for the field of powder coating business. The main target is the reduction of maintenance costs (wear) through segmented processing parts.

Of course, our offer of cooling conveyors – compact and conventional – is an enlargement of this programme. ENTEX dosing units, volumetric, in solid execution, complete our programme for this range. Printing inks and wax pastes are processed as well with our machines.

Since the foundation ENTEX has sold more than 100 planetary roller extruders to the colour and powder coating production. Apart therefrom the planetary roller extruder has been the first well working extruder for the powder coating range at the end of the fifties/beginning sixties. Even today, its compounding quality is indisputable. Also in the colour and powder coating technology the planetary roller extruder offers the widest field of application of all compounding systems.

Our latest developments in the material and spindle technology made the planetary roller extruder to an even more economic compounding technology. Also fine dust, e.g. aspiration material, can be processed again to essentially valuable products in the planetary roller extruder.
In times of increasing logistic costs it is a must that big chemical plants produce and distribute directly into the market. That means, breaking with these costs and creating smaller and more flexible units. Towards the motto that the art of the process technology is in omitting of process steps. For this ENTEX has developed the modular system.

Presently up to 8 modules are belonging to this modular system. These modules are used for injection, mixing, transportation and degassing. ENTEX has developed a multitude of planetary spindles and planetary spindle combinations by means of which dwell time, transport, intensity of mixing and energy transfer can be varied. The patented multifunctional designed intermediate stop rings between the modules enable the measurement of temperature and pressure, the injection of several liquid components as well as the degassing in particular areas. Also the combination of interconnected vertical extruders can be used in our Technical Centre as well as the patented back venting degassing.

A planetary roller extruder for the chemical industry does not need to be horizontal, but can also be designed – as demonstrated here – vertically for the processing of Prepex. This is reasonable when processing a high portion of liquids.

Sludges contain impurities in the form of stones, rubble or similar which can damage the supply and conveying aggregates of the combustors. With regard to fluidized combustion lines there is the risk of unscheduled breakdowns of the line in case such impurities are supplied to this line.

In order to supply sludges to the thermal disposal a specific compounding is required. By dosing of liquid and solid waste material the planetary roller extruder can be operated wear resistant and enables thus the adjustment of the correct calorific value.

TP-WE 150/900-M1
A planetary roller extruder of 1 module for processing of e. g. industrial soap with lateral feeding throughput approx. 1,000 kg/h and a drive 120 KW
It's a small matter to process temperature correctly for e.g. farina by means of the planetary roller reactor and its thermodynamic.

Food Technology

Due to an increasing world population foods are becoming inevitably shorter. Also here ENTEX offers with the planetary roller reactor a concept for the future.

Should fats be more spreadable, ice cream more flavoursome or foods in total refined or regenerated, the planetary roller reactor with its advantageous properties, as already described before, will be suitable for these areas in an excellent way.

FI-WE 150/2700-M3 planetary roller reactor with 3 modules e.g. for processing cocoa-sugar-dispersions

FI-WE 70/1200-M3 RG
A planetary roller reactor, 3 modules, with radial pelletizing for processing of e.g. special malts of differentiated colour depths using different raw materials of malt

FI-WE 70/400-M1 planetary roller reactor in vertical version with 1 module e.g. for use as cooling reactor
When processing PVCu, line loads of more than 600 N/mm are normal as well as the true run of 2 micrometers of the crowned roll, ground hot or cold.

Due to our thermo roller capacity and calender quality are brought into a topical dimension. Vacuum nap rolls and lines for the production of drainage films in the building range with longest service life complete our roller range.

**ENTEX Calender and Vacuum Nap Rolls**

The roller is the simplest element to produce films or plates. For centuries laminar products have been produced in that way.

By its developments ENTEX brought these into a new dimension. Our understanding is: rollers are high-performance parts in the calender, planishing roll or vacuum moulding range.

An example: the history of the calender rolls leads via bottleneck and peripherally bored rolls to the ENTEX thermo roller. The energy transfer corresponds to these steps. The ENTEX thermo roller for the calender and planishing roll range transfers a multiple of energy of a peripherally bored roller at simultaneous line load.
ENTEX Line Technology

We design for you planishing rolls for the production of PVC, PE, PP, PU, TPU, TPO, PET, bitumen etc. for the following fields of application: packing, roof, tunnel, disposal and sarking membranes, naps, drainage as well as lines for the drying or WPC compounding lines, as well.

PET compounding drying and extrusion in one step. In a continuous process PET films are extruded without pre-drying Patent-Nr. DE 10334363

Flatt film unit for the production of films for deep draw purposes

WPC-Compounding Polymer-bound wood-based material compounding, especially for barefoot use floorboards
ENTEX Innovations and Technical Centre

Of course, our Technical Centres in Bochum and Shanghai are available for our customers. Different laboratory and production extruders reflect our capability.

Only together with our customers we can design the process technique of the future. Due to computer-based scales up the achieved test results can be projected forward without problems for the design of the correct production machine for you.

ENTEX Developments

1. Degassing cylinder
2. WPC Compounding megawood®
3. Future trend Planetary Spindles
4. Cocoa-Sugar-Dispersion Plant
5. Central Spindle, segmented
6. Roller Cylinder, segmented
7. Swivelling Feeding Cylinder
8. Special Malt Plant
9. ENTEX-Thermo Roller and Vacuum Nap Roller
10. Middle Centering
11. 8 Module, development to 12 modules
12. World biggest Elastomer Plant in the range of performance 6,000 kg/h
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