apt Hiller GmbH

Automated section transport in a rapidly expanding extrusion plant

With a current annual section production of almost 65,000 tonnes the apt Group, with its two extrusion plants in Monheim and Roermond is one of the top producers in Europe. In Germany the Group commands a market share of around 10 percent. That share should grow further with the help of an ambitious investment programme which began in 2008, which aims to increase production to 80,000 tonnes by 2011. Besides two new presses and the new continuous-throughput homogenisation equipment, a main feature of the investment is also a corresponding extension of the section transport and packing facilities.

What distinguishes the extrusion plant in Monheim from most other extrusion plants is the fact that no extra production area could be made available for the substantial enlargement of section production at this site.

Efficient press operation in a relatively restricted space is only possible when the space devoted to storage and transport is strictly limited. Wide transport paths, along which section racks can be transported by floor-level conveyors, as it were exclude themselves. Without sophisticated and long-term planning, in such a situation expansion of the extrusion plant is unthinkable.

From that standpoint it is understandable that the apt Hiller extrusion plant GmbH was one of the first extrusion plants in Germany to recognise and make consistent use of the potential offered by automated section transport. This, in turn, led very early on – since the year 1989 – to a close collaboration with the company H + H Herrmann + Hieber in Denkendorf which specialises in extrusion plant logistics. When – probably in 2011 – a newly organised packing facility matched to the plant's increased production level begins operating, the plant's four presses will be integrated into the automated logistics system as a whole. At the latest by then the Monheim works, in terms of productivity per production area available, will lead the world.

Step by step automation of the material flow

In Monheim the road to fully au-

tomated section transport has involved several extension steps. At the beginning of the 1990s, and first in the form of an island solution, the material flow for the plant's largest press with an extrusion load of 31 MN (P3) was partially automated. The measures adopted focused on the stacking equipment which, together with the saw, is installed at the end of the cooling bed. The full racks are stacked automatically on one of four roller tracks – respectively two for each heat treatment furnace –, on which they pass through the two furnaces (against the press direction). The two chamber furnaces (supplied by Otto Junker), which are still in use today, each have a capacity of 4 stacks, each of 4 racks.

In a second step, in the mid-1990s the material flow for the two presses P1 (12.5 MN) and P2 (20 MN) was completely automated. These two presses (today of modernised design, with a long run-out, double puller and flying saw) are set up a distance apart. The ageing furnaces are between the cooling beds of the two presses. In both lines the saws and stackers are arranged at the front end of the cooling table, at approximately the same height as the presses.

In this area the filled section racks are placed onto roller tracks with the help of an automatic crane (AMK1) and, in stacks, pass in the extrusion direction through the ageing furnaces arranged next to one another. A parallel roller track for the soft extruded goods bypasses the three furnaces and leads directly to the store area and on to the packing station.

Behind the furnaces is provided a blow-clear station for section up to 8100 mm long. With the help of a transport trolley that can move transversely the section racks are taken to this blow-clear station, where sawing chips and any contamination are removed from inside the hollow sections.

Intermediate storage and distribution is then carried out by a centrally arranged automatic crane (AMK 2.1). In this area the racks can optionally be moved to the downstream packing positions, to further processing stations or to the roller straightening machine. The crane track is extended over the storage area on both sides. On one side (on the right in the press direction) the racks can be set onto the input roller track leading to the roller straightening machine. On the other side, with the help of the said automatic crane racks with section scrap can be set onto a transport track leading to the foundry.

Another special feature of the plant is that the section racks are in any case moved to the adjacent surface treatment units and back again into the extrusion plant by an underground shuttle vehicle on rails. For this shuttle transport the racks are moved into or out of a pit with the help of a vertical conveyor. For rack transport from and to the transfer station a further, three-axis automatic crane (AMK 3) has been installed, which can also fulfil transport requirements in the packing area.

The plant's smallest press, with an extrusion load of 8 MN, has been incorporated in this automatic sequence. Since it is set up somewhat to the side of the other presses, in this case it was found advantageous to bring in the empty racks and return the full ones to the AMK 1 area by hand. The remainder of the sequence then takes place fully automatically, as for the other presses.

AMK 1 crane track above the cooling bed of press P1; on the right is the ageing furnace

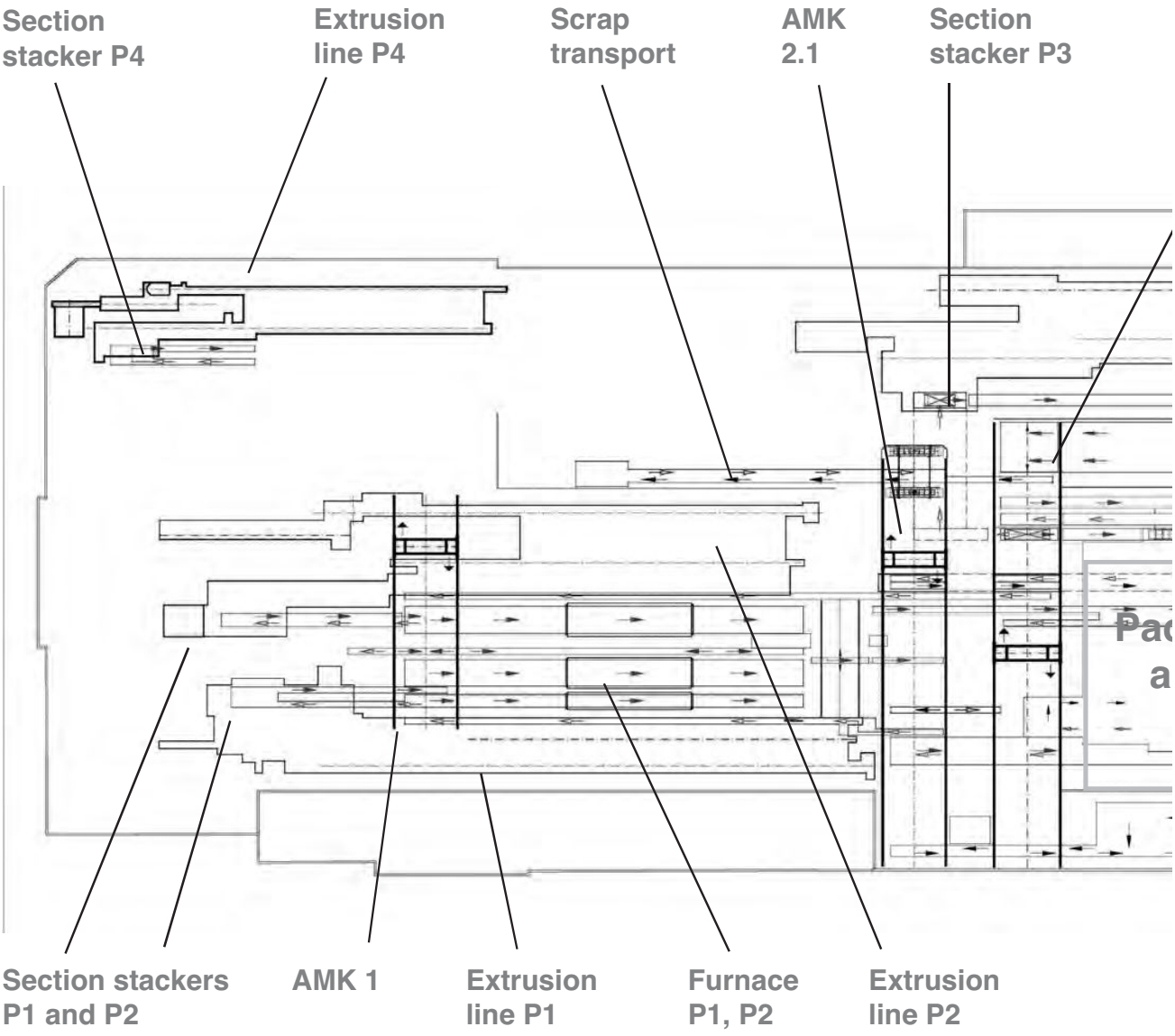
Layout and final capacity

In the context of the planned capacity enlargement of the Group to 80,000 tonnes per year, section production at the Monheim plant has to be increased still further. This will be achieved, among other things, by replacing the 31 MN press with a modern, short-stroke front-loading press of 32/35 MN. The new extrusion press will be fully operational by the middle of 2009.

The new capacity extension has a serious impact on the packing

Transport trolley that can move transversely to the blow-clear station for sections up to 8,100 mm long

Layout and material flow (schematic) in the apt-extrusion plant in Monheim

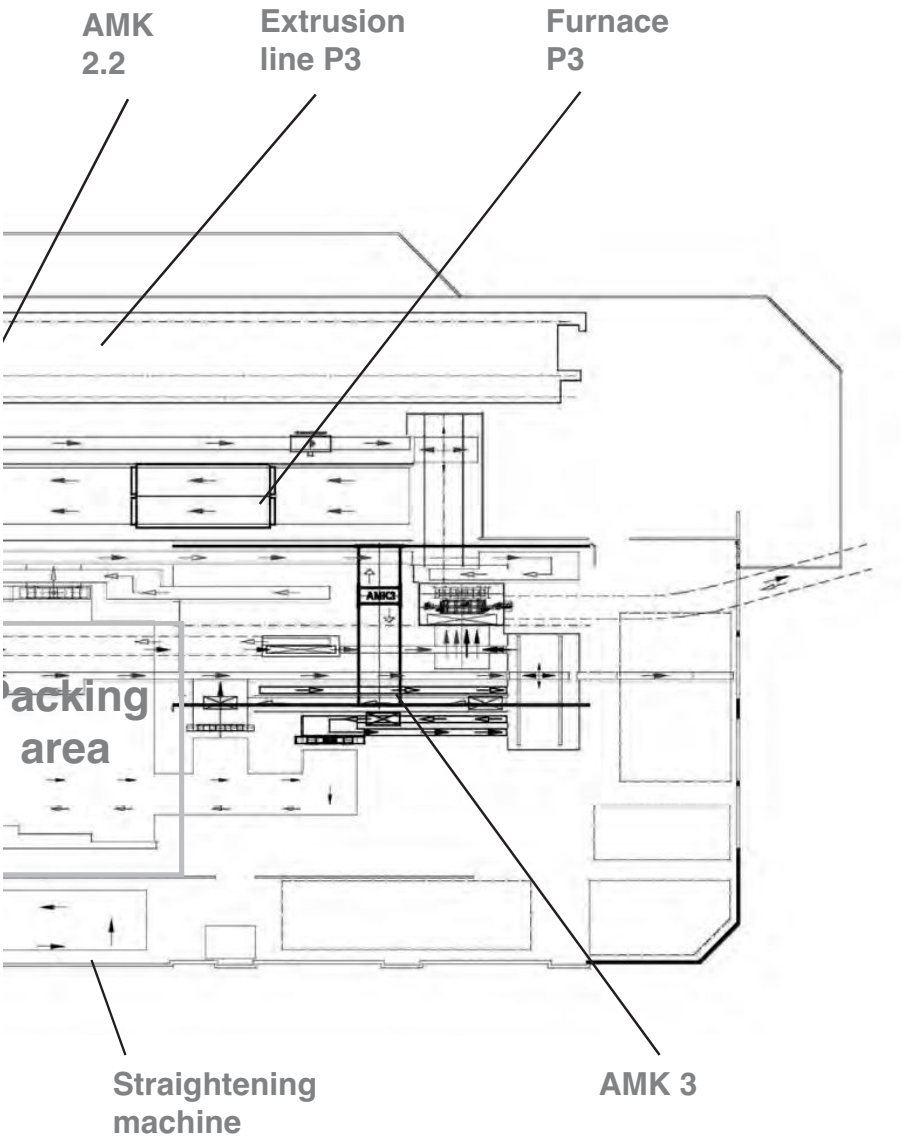


and dispatch facilities. Section dispatch, which was earlier also accommodated in Plant I described, has since been relocated to Plant II.

To be able to put through larger quantities at the packing station, this area was completely replanned under a project heading "New Packing". For the reasons already given, no additional space was available for this. On the same area as the previous section packing facility, in the final version a total of seven highly efficient packing positions (and two more for over-length sections) will be set up. In planning them a number of boundary conditions (- customer-specific packaging, over-length and others) had to be allowed for. The prerequisite for the substantially greater volume is the optimum provision of supplies to the positions, whose goods and packing materials are brought in automatically. The packing positions are ergonomically designed and stress on those working there is minimised by automatic auxiliary equipment.

The redesigning of the packing system is closely linked to material transport. For that reason, at present, even before the new packing positions are set up the material transport during operations will be adapted to the changed circumstances. The new, ultimate concept brings together virtually the plant's entire extrusion production process into a coherent whole. Automation steps carried out previously will now become part of an all-embracing material transport system within the operation as a whole.

One of the most important matters to be resolved in this rationalisation step is to integrate the new 32/35 MN press P3 into the



automated system as a whole. This will be done with the help of a further automatic crane (AMK 2.2), located immediately next to the previously installed AMK 2.1. The store is to be extended correspondingly. Thus, in the plant provision has been made for the special situation that the centrally arranged store will be served by two automatic cranes working in parallel.

Since the cross-sectional dimensions of the sections extruded on the large press were too big for the rack sizes used until then, it was decided already at the time when the press was ordered to use a second, larger rack variant for its products. For that reason, in the plant large and smaller racks circulate in parallel. A consistent logistics system must take this fact into account and must ensure that the individual transport devices are suitable for both rack variants. This also concerns the roller tracks, which are designed for racks of both types, and the crane transport as well.

Planning and control of the system as a whole

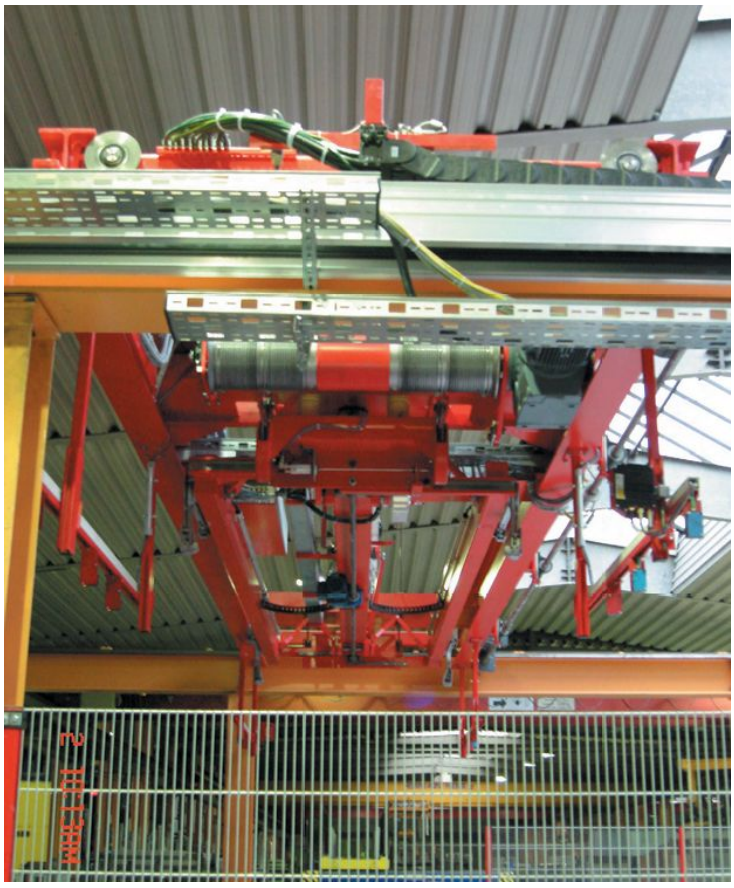
The basis of such a complex material flow system is careful advance planning. The special example of this plant in particular clearly shows that this is a matter for specialists who, on the one hand, have mastered the secrets of material flow planning, but on the other hand also have comprehensive knowledge of the processes involved in extrusion plant operation.

The fundamentals for any planning exercise are always the individual circumstances of a project and the planned figures of the production operation. In this – as has been demonstrated for H + H in well over 50 successfully completed extrusion projects – the guidelines to be taken into account by the planning are always different. In this special case, for example, the planning had nothing to do with the simpler situation of a linear material flow, in which, as in most plants, the presses are set up in parallel and the material flow takes place in one direction. Further boundary conditions that made things more difficult were the extremely small area available and the limited height of the production sheds.

In all cases planning starts with a survey of the existing situation, in which all the data are recorded. The quantitative framework on which the planning would be based (press capacity, ageing furnace capacity, etc.) is determined by the production operation.

For the definition of the situation to be aimed at, the planning also had to take into account in a general way that the values concerned are not static, but relate to a dynamic, variable operating situation. This means that an extrusion plant must be to react flexibly to changing market needs. It is essential to plan changes of the material flow in a far-sighted manner.

In this, an overall plan must take into account not only the section transport, but also the transport of all the additional auxiliary mate-



Automatic crane AMK 2.2

rials required for the production process. In this context the transport of spacers and packing materials can be mentioned in particular. In general, in projects of this type the necessary changes must be implemented without having to close down on-going extrusion operations. Unless this can be achieved, the intended investment is doomed to failure from the start, since it can no longer pay off.

When the individual material flows have been defined and the necessary areas have been calculated, the solution then has to be structurally implemented. For this, in the first instance tried and tested building blocks – floor-level conveyors, automatic crane units and others – are available, whose dimensions and capacities can be adapted to the respective requirements.

Automatic crane AMK 2.2 with a double gripper for the simultaneous transport of two section racks

In this planning phase in many cases it becomes evident that with the available standard components the planned material flow cannot be achieved, or only inadequately so. At this point the innovative abilities of the planning team are called into play. Examples of newly developed special solutions are automatic cranes arranged one above another and crossing (Thöni) or the automatic division of tasks between a number of automatic cranes working in combination (Pandolfo).

In the Monheim extrusion plant of apt Hiller, for reasons already stated the achievement of the planned volume flows entailed particular difficulties. This made it necessary to develop several special solutions.

First, to be able to deal with the volumes envisaged two central automatic crane units had to be arranged in parallel. In addition, because their capacities would not be sufficient if operated conventionally, both were equipped with special swivelling gripper systems that allow single or double rack transport.

Furthermore, due to the flexibility desired and because of the restricted space available, it was unavoidable that individual conveyor tracks for the transport of both rack types had to be laid out and material flow streams crossing others with under-floor conveyors had to be designed.

For lack of storage space, in future the large system racks for the P3 press will be stacked inside one another in “cascades” of 12 and taken to a conveyor buffer of the production system. This too will be done fully automatically by the crane units. In any case, however, the design of the racks had to be modified to enable this special stacking.

Costs and utility

In developed industrial regions the need for and utility of flexible automation are nowadays no longer seriously questioned. Extrusion press operation benefits from au-

Roller track for the transport of section racks with different widths

Rack transport for over-length sections

Section racks behind the ageing furnace for press P2

tomated material flow in many respects. The rationalisation effect is made directly visible by the need for fewer workers, the lower scrapping rate and the disturbance-free progress of work. Moreover, with the same personnel the company can adapt flexibly to market circumstances. The extent to which the economy and flexibility can be increased in specific cases depends on the initial situation and the circumstances in each case. No generally valid figure can be given, for that very reason. On average, experience shows that the so-termed Return of Investment for the measures adopted to automate an extrusion plant is no more than 4 to 5 years.

On the example of the Monheim extrusion plant of apt Hiller it is also clearly evident that besides considerations of economy and flexibility, other reasons too speak for automated material flow. Namely, a production increase on such a scale would not have been possible there at all without automated section transport.

An ambitious growth programme

In 2007 the two extrusion plants of the apt Group in Monheim and Roermond, with a total of 7 extrusion lines, produced 69,600 tonnes of sections. Of these the Monheim works, with a total of 4 presses and around 260 employees, accounted for 45,000 tonnes. Although with this tonnage the Group is already one of Europe's important producers, at that time it initiated a further, ambitious investment programme.

In the foundry of the Monheim plant a new continuous-throughput homogenising furnace (from market leader Hertwich Engineering) with a capacity of more than 20,000 tonnes per year was built. With that output, and allowing for a wastage rate of around 20%, this furnace can deal with an extrusion capacity of approximately 100,000 tonnes. The casting length was increased from 5000 mm to 7000 mm. The investment cost amounted to 2 million euros.

Meanwhile, the next major investment took place at the plant in Roermond: on 25 February 2008 "Project MN 25" started there. That project includes the construction of a new press with 25 MN extrusion load, to replace the old and much smaller 16 MN press. Since the new press is almost twice as large, office space, workshops and stores had to give way to it. For these, a new building with a floor area of around 1,250 m^2 was erected.

At the same time a 32/35 MN press was ordered for the Monheim plant, to replace the existing 31.5 MN press. This started operating in May 2009. Both of these are modern, short-stroke front-loading presses supplied by market leader SMS Meer, which are noted for short cycle times and correspondingly high productivity. The apt Group gives the investment volume for the two new presses as about 21 million euros. The ultimate aim of these investments is to provide the best possible service to new extrusion markets in the transport sector, where the trend is unmistakably towards larger section dimensions and alloys that are more difficult to extrude.

Modernisation of the extrusion capacity goes hand in hand with a corresponding extension of the fully automatic logistics. At both plants, that aspect is in the hands of H + H Herrmann + Hieber. The extrusion plant has been working together with the logistics specialist H + H Herrmann + Hieber located in Denkendorf since 1989. When the automation of the logistics has been completed, the plants will have a material transport system automated throughout, all the way to the – also automated – packing positions.

In mid-2008 the Group opened another large building site in Cheb in the Czech Republic, where a further plant is to be put up. The first construction stage, with an investment volume of 7.5 million euros, will be completed in mid-2009; the new extrusion plant will then follow, probably during the same year. The total investment layout will amount to 36 million euros.